

FIVE TECHNICAL REPORTS

FOOD AND AGRICULTURE

Submitted to the United Nations Interim
Commission on Food and Agriculture by
Its Technical Committees on Nutrition
and Food Management . Agricultural
Production . Fisheries . Forestry
and Primary Forest Products . Statistics

Washington
August 20, 1945

THE MEMBERS of the United Nations Interim Commission on Food and Agriculture are aware that over the past year five Technical Committees, whose work has been coordinated by a Reviewing Panel, have been studying problems of nutrition and food management, agricultural production, fisheries, forestry and primary forest products, and statistics. Their assignment was to prepare comprehensive background material and to make recommendations regarding the future work of the Food and Agriculture Organization of the United Nations in these fields, particularly during the first year or two of its existence. It was felt that such reports would be useful not only to the delegates at the First Session of the FAO Conference, but to the Director-General and staff. It was also felt that the reports would save a good deal of work during the early stages of the organization when the staff will be small and pressed for time.

These reports have now been printed and I take pleasure in transmitting them herewith to Members of the Interim Commission. I believe that the Members will find them valuable documents, full of worthwhile information and suggestions for the future work of FAO. Needless to say, their transmittal constitutes no endorsement by the Executive Committee of the views expressed or the recommendations made. Rather, these views and recommendations are presented as the basis for discussion by those committees of the FAO Conference which will be concerned with technical questions. In reading the reports, it should also be kept in mind that they were completed some time before the United Nations Conference at San Francisco.

I am sure that the Members of the Commission would wish me to express their profound gratitude to those responsible for preparing these reports. The members of the Technical Committees, whose names are listed in the reports, have given unselfishly of their time and effort, often coming from considerable distances to attend meetings and, more important, working individually for many hours to prepare material for the meetings. This is true, not only of the

Committee members, but of those whom they consulted and who in many cases prepared subsidiary or supplementary reports on detailed aspects of the main reports. Thus, the latter are backed by documentation which in itself will prove useful to those concerned with FAO's work. These supplementary documents are on file in the Registry of the Interim Commission.

This willingness of highly qualified persons from many parts of the world to give their services unstintingly to launch the Food and Agriculture Organization augurs well for its future.

Washington, D. C.
August 1, 1945.

L. B. PEARSON,
Chairman.

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NUTRITION
and
FOOD MANAGEMENT

**Report of the Technical Committee
on Nutrition and Food Management,
submitted to the United Nations
Interim Commission on Food and
*Agriculture***

April 9, 1945

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INTRODUCTION

1. The purpose of Part I of this report is to emphasize the urgency of the problems of malnutrition and undernutrition throughout the world, to summarize the scanty information available concerning the incidence of malnutrition in countries of varying climates and stages of economic development, and briefly to describe some of the measures that have been applied successfully in the solution of these grave problems.

2. Part II of the report analyzes the manner in which, for the first time in history, certain governments by integrating nutritional measures with food supply and general economic programs have been able to secure some nutritional progress even in wartime. It then proceeds to suggest how the wartime experiences of these and other governments might be applied after the war to achieve freedom from want of food in Western countries and necessarily slower but still substantial progress toward this goal in underdeveloped countries.

3. Although the final responsibility for progressive nutritional and food policies rests with individual governments, the Food and Agriculture Organization of the United Nations has a vital part to play in analyzing problems that are common to many areas, collating and disseminating the results of research and experience, indicating the fields in which further research is necessary, and ensuring that the best expert advice is available to governments on request. Hence Part II of the report includes a number of specific recommendations for action by FAO. These recommendations are collated in Part III.

PART I. NUTRITION

1. PREVALENCE OF MALNUTRITION THROUGHOUT THE WORLD

4. In its final report the League's Mixed Committee¹ deplored the paucity of evidence available concerning the prevalence of malnutrition throughout the world. The position still remains obscure. Progressive accumulation of different types of evidence since 1936 leaves no doubt of the great extent of under- and malnutrition, but the information available does not permit of the kind of statistical survey that will be needed for the work of FAO.

PREVALENCE OF MALNUTRITION IN 1936

5. The Mixed Committee, in its final report, gave a few examples of the nutritional situation, drawn from different parts of the world. The following is a brief summary of its findings:

As regards western Europe and the United States of America, the committee concluded that much malnutrition existed among the lower income groups, available evidence suggesting a figure between 20 percent and 30 percent of the entire population. Although food consumption was relatively high in the British Dominions, malnutrition was not uncommon, particularly among children. In central and eastern Europe malnutrition prevailed extensively and there was often a lack of staple foods as well.

In every country, according to the Mixed Committee, an appreciable portion of the population is not getting enough of the foods necessary for health and efficiency.

The Inter-Governmental Conference on Rural Hygiene, convened by the League of Nations in Bandoeng in 1937, came to the conclusion that the diets of the great mass of the population in the East are grossly deficient in terms of any standards of adequacy put forward by nutrition workers, and that nutrition is of far greater importance to the people of the East and to Eastern health workers than is the case in the West. This was borne out by the fact that in Asia and the tropics about 75 percent of the 1,150 million inhabitants consumed diets much below the standard for health.

PREVALENCE OF MALNUTRITION BETWEEN 1936 AND 1943

6. The work of the League was followed by intense activity in the field of nutrition throughout the world. Many governments studied the results of the economic depression on the health and nutrition of their people in the depressed areas. National nutrition committees

¹League of Nations, Mixed Committee on the Problem of Nutrition, *Final Report . . . on the Relation of Nutrition to Health, Agriculture and Economic Policy*, Geneva, 1937, p. 297.

began systematically to study food consumption habits and the state of the people's nutrition. A few extracts from these studies¹ give their general tenor and emphasize the conclusions drawn by the Mixed Committee. All of this material and much more was presented to the Hot Springs Conference by the several delegations.

7. In Chile the fundamental deficiency in the people's diet is the low level of consumption of milk and milk products among pregnant and nursing women and children, and of foods containing the vitamin B complex among working adults. The high infant mortality in Chile is said to be due to the scarcity of mother's milk, due in turn to faulty diet of nursing women. Lack of milk in infancy causes impaired development and imperfect calcification of bones and teeth, common defects among the children. High sickness and death rates from tuberculosis constitute one of the chief characteristics of the national health picture; on them dietary deficiencies appeared to exert an appreciable effect.

8. In China there is general undernourishment; deficiency diseases prevail, malnutrition lowers resistance to infectious diseases, which are rife, and expectation of life is low. Simple goiter and beriberi—both deficiency diseases—occur widely in China. Osteomalacia is reported from large areas in the north and northwest, from smaller areas in the center and south; it attacks from 1 to 5 percent of all women over the age of puberty in those regions. Xerophthalmia and keratomalacia are known to occur in large areas of the northeast and southeast; pellagra is most commonly reported from provinces where physicians with modern training are most numerous, i.e., where it is most likely to be recognized.

9. A variety of nutritional conditions is met with in Egypt where, in general, the diet is low in protein of high biological value, short in the nutrients found in milk and milk products, and deficient in other vitamins as well. Surveys have shown that dental caries, anemia, and rickets are common in children and are also found among adults. Pellagra and rickets as well as night blindness and xerosis of the cornea are common.

10. In prewar Poland rickets was the principal deficiency disease, while nutritional anemia was said to occur in 25 percent of the population. There was wide underconsumption of such foods as meat and milk, particularly in the rural districts.

11. In India the average daily caloric intake of a group of poor villagers in South India was 1,700 and that of poor families in a Madras suburb 1,800. A tentative estimate has been made that in normal times at least 30 percent of the population representing 100 million people actually do not get enough food of any kind. Fifty per-

¹See the following reports which were distributed to Section I, Committee I of the United Nations Conference on Food and Agriculture, held at Hot Springs (Virginia, U. S. A.), May 18 to June 3, 1943:

- (a) *Bases for a Nutrition Policy in Chile*
- (b) *Problems of Nutrition and Dietary Requirements in China*
- (c) *Food Consumption Levels and Requirements—Malnutrition and Under-nutrition in Egypt.*
- (d) *Consumption Levels and Requirements in the Prewar Period in Poland*
- (e) *An Outline of the Problems of Agriculture and Nutrition in India*
- (f) *Prevalent Causes and Consequences of Malnutrition in Mexico*
- (g) *Food Situation in the Netherlands East Indies*

cent of the mortality in any given year occurs in children under 10 years of age, the corresponding figure for England being only some 12 percent. Beriberi prevails among adults in northeast Madras, and infantile beriberi in this region is the cause of many infant deaths. Keratomalacia is the commonest cause of blindness in South India. In certain parts of northern India osteomalacia and rickets constitute formidable health problems. Many other forms of deficiency diseases prevail in India, such as goiter, anemia, and epidemic dropsy.

12. In Mexico the consequences of malnutrition are decreased working capacity; disorders in growth and development; and high general, infant, and other special mortality rates. The most common types of deficiency diseases are, in descending order, pellagra, beriberi, nutritional edema, different forms of anemia, xerosis, cutaneous signs of a deficiency of vitamin A, and riboflavin deficiency. Malnutrition plays an important part in decreasing the resistance to tuberculosis and other infectious diseases.

13. In Java deficiency of vitamin A is frequent, xerophthalmia causing thousands of cases of blindness. Beriberi occurs mainly in the large cities and among the island populations. Goiter is common in the eroded mountain regions, while the prevailing anemia may be due either to malnutrition or to the common intestinal parasites. To malnutrition is ascribed the high malaria and infant mortality rates. The prevailing diets are low in protein and fat, deficient in animal protein, poor in calcium, and at the best not adequate in vitamins.

14. The delegation of the United Kingdom presented to the Conference a summary of the report *Nutrition in the Colonial Empire*,¹ which concerns forty-eight different territories with a population of over fifty-five millions. This inquiry, initiated by the Prime Minister in October 1936, was a direct result of the League's work. The report concludes that colonial dietaries are deficient in animal protein, fat, calcium and phosphorus, iron, and sodium. Their general character suggests that they are also deficient in the various vitamins. The results of such deficiencies are seen in the occurrence of deficiency diseases, as well as in deficiency states which prevent the full enjoyment of health and aggravate many other diseases. Deficiency diseases due to the lack of vitamin A are most common; they are manifested by affections of the eye, changes in the skin, and other symptoms. Beriberi occurs frequently in rice-eating countries. Pellagra is reported fairly frequently, scurvy and rickets only occasionally. Diseases particularly aggravated by malnutrition include ulcers, skin affections, leprosy, tuberculosis, and malaria.

THE UNDERDEVELOPED COUNTRIES

15. The underdeveloped countries constitute some forty out of the sixty separate nations and include most of the colonial areas. They are inhabited by 1,500 million of the world's 2,100 million people. Some are sparsely populated; in others the density of population presses hard upon the developed means of subsistence. All of them are

¹Great Britain. Economic Advisory Council, Committee on Nutrition in the Colonial Empire, *Nutrition in the Colonial Empire*, London, 1939, First Report, Parts I and II, Cmd. 6050 and 6051.

poor and all suffer from malnutrition with its inevitable ill health and premature death.

16. The position in Asia is of particular importance. The Western world has been deeply impressed by the fact that the population of India has increased during the last decade by fifty million, keeping pace with advances in food production if not actually exceeding it. The rate of growth in India—1.4 percent per annum between 1931 and 1941—was exceeded in Java, the Philippines, Formosa, and Thailand. No definite figures are available for China.

17. It is a matter of the utmost concern to the world as a whole that the underdeveloped countries, particularly those with a high density of population, should be assisted to achieve an early and progressive improvement in standards of living. Some small progress in nutrition may be achieved by the means described in this chapter. In the long run, however, partial measures will only aggravate the problem, which must be tackled boldly if it is to be solved at all. To secure economic progress in these countries there will be need for every type of development, including nutrition, agriculture, transport, industry, education, and sanitation. Technical assistance and investment of capital goods will be required. It is clearly preferable that the assistance should be furnished through international organizations in which the recipient countries have full membership and hence a voice in the determination of policy. FAO should stand ready to assist such countries in the development of their agriculture, forests, and fisheries and in the improvement of their peoples' nutrition. It will be the responsibility of other international agencies to ensure the success of FAO's efforts by providing for the other forms of assistance required.

NEED FOR INFORMATION ON FOOD CONSUMPTION

18. In order to appraise the dietary and nutritional status of a people, various types of information are needed—on food production and consumption as well as on the results of biochemical and clinical examination. Information on food consumption particularly is essential to the work of FAO, but at present it is scattered and incomplete. While the data from various countries vary widely in value, the mere act of compiling and publishing those which exist would be an important means of improving national statistics and arriving at better results for the world as a whole. As further information becomes available it will no doubt emphasize the importance and urgency of the world problem of underconsumption, since the countries now publishing the most complete food consumption data are the most highly developed.

2. IMMEDIATE STEPS TO MEET URGENT PROBLEMS OF MALNUTRITION

19. During the first FAO Conference the attention of the delegates will no doubt be focused on immediate steps to meet the most urgent problems of malnutrition, especially in the less developed countries. Hence, in this section of the report are described some of the measures and methods that have been sufficiently tried and tested, and that may be applied without delay in many different countries.

20. Governments that take steps to improve the nutrition of their people will be moving with the tide, at least in Western communities and probably in many others. For the tendency has been for the people of such communities to consume in addition to energy food more and more milk and dairy products, eggs, fresh fruits and vegetables, and meats. This tendency has been accentuated in some countries during the war; witness the apparent shortage of milk, meat, and other valuable foods in the United States, for example, in the face of greater average supplies available for civilian consumption than ever before. But this tendency, as the Mixed Committee pointed out, has been largely instinctive and unorganized. Governments must take the lead, and "There is no country in which conditions could not be improved with more Government help and direction. . . ."¹

21. The recommendations of the Hot Springs Conference furnish a useful guide to early action. In most countries immediate benefits would result from putting these recommendations into practice without delay. However, nutritional advance has been made possible by advances in science, and scientific resources, human as well as material, are fewest in the countries where the need for nutritional improvement is greatest. Since "more than half of the world's people still face the elemental problem of producing enough food to supply their ever-growing numbers even at existing meager levels of living,"² any long-term nutrition program in the less advanced countries must suffer from the lack of specialized personnel, scientific knowledge and community organization.

22. An essential part of FAO's work will be to overcome these deficiencies. Through FAO the more advanced countries will have the opportunity to cooperate with the less developed in the interests of the world community. Rich experience and specialized personnel from many countries may be made available through FAO, so that the less advanced countries may more rapidly succeed in improving the nutrition of their people. For the Hot Springs Conference made it abundantly clear that the raising of nutritional levels in the least as well as the most advanced countries was the opportunity and responsibility of all.

MEASURES FOR VULNERABLE GROUPS

EXPECTANT MOTHERS

23. Of the immediate measures the most urgent are those that concern vulnerable groups—those groups most subject to physiological stresses and strains, who are at the same time least able to obtain for themselves the right kinds of food. The health of the child is the kernel of the problem but it is necessary to begin before the child is born. A great amount of evidence has accumulated in recent years to emphasize the importance of the diet of expectant mothers on the life and health of their children. Proper diets for pregnant women make childbirth less difficult, reduce premature births, lessen infant mortality, produce sturdier children, and conserve the health of the

¹League of Nations, Mixed Committee on the Problem of Health, *op. cit.*, p. 35.

²Milbank Memorial Fund, Twenty-second Annual Conference, "Demographic Studies of Selected Areas of Rapid Growth," *Proceedings of the Round Table on Population Problems*, New York, 1944, Foreword.

mother. In countries with well-organized health services, many expectant mothers may be reached through the health institutions, but this is not enough. The cooperation of physicians, nurses, and midwives in private practice or public employ should be enlisted in the attempt to reach larger numbers and to correct faults in their diets by educational measures or the provision of supplementary food, or both. In more primitive conditions, where it is difficult to collect information on diets, it would be well to promote the distribution of suitable food directly to as many pregnant women as possible. Milk and milk products, eggs, fresh vegetables and fruits, wheat germ, yeast, and fish-liver oils are examples of foods that will usefully supplement many deficient diets.

NURSING WOMEN

24. Properly fed mothers are able to nurse their babies, and breast feeding disposes of many of the health problems of infancy. But nursing as well as pregnant women require extra food. Hence, an important immediate measure is to ensure the provision of suitable food for nursing women; this may be done through maternity and infant welfare centers, or where these do not exist by whatever other means ingenuity can contrive.

THE PRESCHOOL CHILD

25. Once the child is weaned (and in tropical countries there is often advantage in prolonging the period of nursing), special attention must be given to its food. This need continues through the preschool period, the school years, and adolescence. "The damage done by faulty feeding in the prenatal period, in childhood, and in adolescence cannot be repaired later in life."¹

26. In the less well-organized communities the preschool years present a difficult problem, yet, second only to the prenatal period and early infancy, these years are of importance to future health and vigor. More difficult to reach than school children, the long-term benefits to health from adequate diets for preschool children are even more rewarding.

27. Many preschool children may be reached through health clinics and nursery schools. Any community would find it worth-while to develop a system of keeping in touch with expectant mothers, infants, and preschool children so that there might be continuous supervision of children's health and nutrition until they enter school, where the difficulties of health supervision become less acute.

THE SCHOOL CHILD

28. In the schools, periodic check-ups of health and nutrition and the provision of suitable school meals should be combined with education in proper food habits. This method is firmly established in many of the advanced countries. It is sometimes said that parents will take less responsibility for the correct feeding of their children if school meals are provided, and that these tend to disrupt family life. Similar

¹ League of Nations, Mixed Committee on the Problem of Nutrition, *op cit.*, p. 41.

arguments were heard years ago when the state began to organize public schools and to make attendance compulsory. Children who receive suitable instruction in the selection and preparation of food at school carry the lessons home to their parents. Instead of disrupting family life, properly organized school meals tend to preserve it by favorably influencing food habits and improving the nutrition of the whole family. Moreover, the centralization and consolidation of the modern school system in advanced countries often make it physically impossible for many school children to go home for lunch.

SCHOOL MEALS

29. Meals served at school may take the form of hot lunches or a midmorning or midafternoon meal. The school lunch, which replaces a meal prepared at home, does not necessarily add to the amount of food consumed, although it should be so planned as to bring the whole diet up to adequate levels in all nutrients. Midmorning or midafternoon meals may be more difficult to arrange, but they do supplement the amount of food consumed and have other advantages as well. The Oslo breakfast, consisting mainly of raw foods, gives little trouble in preparation and has the great advantage that it does not entail the sometimes considerable losses in nutrients in large-scale preparation and cooking. Midmorning or midafternoon meals might consist of milk or milk solids, whole-cereal biscuits, rolls or bread, and any available fish, vegetables, or fruits.

30. The cost of school meals, like the cost of schooling, should be a charge on the public funds. Recent studies have shown that children whose diets have been inadequate in thiamine learn appreciably better when they receive added amounts. Many studies have revealed the benefits to growth and health that result when the diets of school children are suitably supplemented by well-planned school meals.

SCHOOL GARDENS

31. Wherever possible, school gardens should be used in connection with school meals. The school garden may be a demonstration of food suited to local cultivation and methods of growing them. No child should be allowed to grow up without some knowledge of how food is produced, and the school garden, if properly managed, will inculcate this and many other important lessons. The children should be allowed to perform the work with proper guidance and under competent supervision. A combination of school garden and school meals offers the intelligent teacher many opportunities to impress on the minds of the children important lessons on the growing and selection of foods, their preparation for the table, and the common existing food deficiencies. School meals and school gardens, while important as sources of good food, may be of far greater nutritional importance to school children and their families, if their full potentialities for education are properly exploited.

ADOLESCENTS

32. Adolescence is a particularly critical period for nutrition since it is often one of acute physiological stress. The sickness insurance institutions in several countries, notably prewar Austria, found it necessary to give special attention to the health and nutrition of

apprentices, in order to prevent sickness and breakdown when they became workers. Various methods were used, including summer vacations in the mountains or at watering places, where the health of the apprentices could be built up by an abundance of good food, recreation in the open air, rest, and proper medical care. The provision of extra food for adolescents should be included in the nutrition program for the vulnerable groups. This has been done during the war in the United Kingdom.

WORKERS IN INDUSTRIAL COUNTRIES

33. Countries of high industrial development have found it necessary during the war to pay special attention to the health and nutrition of industrial workers upon whom productive capacity ultimately depends. Methods of providing suitable food to these workers are described in the second part of this report. As the countries of the world become increasingly industrialized, this subject will require greater attention because of the tendency to draw workers from greater and greater distances, since motor transport makes it possible to haul workers cheaply to plants and plants are often located at some distance from built-up communities. While modern industrial practice tends to reduce the intensity of manual labor, it calls for increasing alertness and concentration, qualities not commonly found among the undernourished. Many studies carried out in various countries have shown that workers' families spend a relatively very large proportion of the family budget for food, and the quality of their diets quickly suffers when food prices rise or the budget is otherwise thrown out of balance.

34. That the state can make large contributions to the health and nutrition of a considerable proportion of its working citizens by encouraging and assisting in the establishment of canteens or restaurants at work plants and by using these to supplement workers' diets and to teach them good food habits, is a lesson that has been emphasized by the present war.

WORKERS IN TROPICAL AND COLONIAL TERRITORIES

35. In tropical and colonial territories the proper nutrition of workers, especially native labor, constitutes an even more important problem. The terrible losses of life and efficiency when such labor forces were inadequately fed have been shown to be preventable by experience in the Belgian Congo, on the Rand in South Africa, in Kenya, Northern Rhodesia, East Africa, Zanzibar, and many other regions. On the Kisumu-Yala Railway Construction in East Africa the provision of proper diets for workers reduced the proportion of deaths among them to one death per three and one half miles, "whereas in prewar constructional work of the same kind in this territory the death rate was many times this figure."¹ In the seven-year period 1926 to 1932 the mortality of native laborers on the Union Minière properties in the Katanga (Belgian Congo) fell progressively from 53 per 1,000 to 8 per 1,000 owing to improvements in feeding, housing, and the prevention of disease. In the Belgian Congo much information has been acquired as to the best form of diet for the laborer, having regard to

¹Great Britain. Economic Advisory Council, Committee on Nutrition in the Colonial Empire, *op. cit.*, Part I, Cmd. 6050, p. 95.

his traditional food habits.¹ On the Rand the Central Mining-Rand Group, employing 300,000 laborers a year, include in the ration "mealie meal" bread having not less than 64 percent of wheat flour, beans, meat, nuts, and fresh vegetables to a caloric value of 4,400 on the minimum scale.² Records show that 66 percent of 20,000 workers gained an average of nearly seven pounds in their six months' stay at the mines.

36. Many more examples could be given of the beneficial effects of improving the diet of laborers in underdeveloped countries, among whom death and sickness rates and inefficiency have been tragic and striking.

PUBLIC INSTITUTIONS AND SERVICES

37. Every government is responsible for the food of large numbers of individuals in state schools, hospitals, relief centers, charitable and benevolent institutions, and the armed forces. This presents opportunities for demonstrations of the value of correct feeding in addition to the benefits to health resulting from improving diets. The fact that the principles of modern nutrition have governed army and navy rations in the present war is without doubt largely responsible for the generally low sickness rates as well as the reported absence of deficiency diseases among these forces.

38. The several measures for the vulnerable groups which have been described above benefit the food producer as well as the food consumer, for they result in a steady—usually an increasing—demand for a variety of food products, especially those rich in essential nutrients. Consequently governments determined to improve the diets of their people can adopt and promote several or all of a series of measures that have been shown by experience not only to benefit vulnerable groups but also to provide a better market for agriculture. Even if these measures are carried out entirely at public expense, the direct provision of food to such groups is a relatively inexpensive method of relief, and in the long run the benefits to health bring dividends far outweighing the sums expended.

VALUE OF FAO

39. Properly organized and adequately financed, the Food and Agriculture Organization of the United Nations will be most helpful to all governments wishing to improve the national nutrition, for through it they will be in a position to tap the results of long, sometimes painfully acquired experience in the different parts of the world—experience acquired under a wide variety of social, economic, and political conditions. Some idea of the value of that experience is suggested by the brief illustrations presented below.

IMPROVEMENT OF STAPLE FOODS

40. Improving the quality of staple foods is a rapid and effective means of raising national levels of nutrition. Many authorities believe that the first step to take in less developed countries is

¹ *ibid.* p. 93.

² *ibid.*, p. 93.

to improve the quality of the cereal that forms the basis of the diet.

41. *Rice.* "Rice is the staple food of nearly one-half of the world's population."¹ Hulled rice (as opposed to polished rice) contains good quality protein, is an excellent source of vitamin E, and a fairly good source of the vitamin B group. It is low in vitamin A, Vitamin C is probably absent, and its mineral constituents are low. Polished rice is a much less adequate food, its protein, mineral, and vitamin content being considerably reduced. Those who depend upon it as a staple food suffer high rates of beriberi. The vitamin B₁ content of rice is also reduced by improper storage and preparation; washing before cooking and too much water in cooking cause considerable losses.

42. Methods have been worked out to prevent a large part of these losses. In some parts of India and elsewhere in the East, rice is parboiled and in these regions beriberi does not prevail. Parboiling consists of soaking rough rice in water, steaming and drying it. Subsequent washing does not remove so much of the vitamin B₁. A rice bread made with lime water by the Annamites in French Indo-China is very rich in calcium, which in ordinary rice products is extremely low. In the United States of America where a considerable amount of rice is consumed in some regions, various methods of retaining or adding the deficient nutrients are being tested. In Madagascar freshly husked red rice is prepared by pounding; this protects the consumer from beriberi since a proportion of the outer layers containing B₁ is preserved.

43. Hence, there are several methods of improving nutrition in rice-eating countries: legislation, as in Madras, on the degree of milling (polishing); parboiling, which at the present writing appears to be the most practical method; better methods of storage; enrichment with the deficient nutrients; education in methods of preparation; and of course the provision in other articles of the diet of the missing or deficient nutrients.

44. *Flour and bread.* In wheat-eating countries the introduction of the steel roller mill permitted a more and more refined product in which many of the nutrients present in the wheat berry were greatly reduced in amount. Since, in Western countries, bread is the poor man's staple food, dietary surveys have revealed that a large proportion of the low-income groups do not obtain sufficient amounts of these nutrients, and when white bread is used it is difficult to work out a low-cost diet containing sufficient amounts of the vitamin B complex. Methods of improving the nutritive quality of flour and bread have been adopted in a number of countries, particularly during the war when it became extremely important to maintain national health and nutrition; some of these methods are described in more detail in subsequent pages. In the United Kingdom during the war all bread was required to be made of 85-percent-extraction flour, while in the United States all white bread was enriched by order of the War Food Administration with thiamine, riboflavin, niacin, and iron. The addition to,

¹*Ibid.*, p. 186.

bread of nutrients that do not change its color, texture, or taste, is a rapid and painless method of improving nutrition.

45. Another method of improving white flour and white bread is to add a liberal proportion of food yeast. A liberal percentage of soya-bean flour is also a valuable addition. It is the practice in the United States to add milk solids to breads of various types in the proportion of about 3 per cent dry weight, and the Food and Nutrition Board of the National Research Council has recommended the addition of milk solids to bread in the proportion of 6 per cent when more dry milk becomes available for civilians.

46. Flours and breads in less developed countries might also be enriched by the addition of calcium carbonate. In the United Kingdom calcium was added to the national 85-per cent. extraction wheat-meal loaf.

47. Iron might well be added to flours used in tropical countries since anemia is very common as the result of the wide prevalence of intestinal parasites.

48. *Maize.* Corn, a popular cereal in many parts of the world, is poor in niacin. Thus pellagra is common among populations relying largely upon this cereal—in the southern parts of the United States, in India, Italy, Egypt, Rumania, and elsewhere. When the pellagra season coincides with sowing or harvesting of crops, a vicious circle of ill-health and economic loss is created. Many methods of prevention have been used. Encouraging people from pellagrous regions to cultivate vegetable gardens is a common and useful practice. Dry yeast is often distributed to potential victims to prevent attacks. In Rumania the army moved its cooking vans into villages where the disease was known to prevail, and distributed whole-wheat bread to the people at the appropriate time. The Food and Nutrition Board of the United States National Research Council is sponsoring experiments in the enrichment of corn meal with niacin. One difficulty is that the milling of maize in the United States is not so centralized as is the case with wheat flour. There are thousands of small millers with little equipment, who grind only when a farmer brings a bag of corn to the mill. Nevertheless, some success has been achieved by working out a simple mechanism whereby these millers can add the needed niacin without using any complicated machinery or making complex calculations. Once a suitable method has been worked out, legislation may be adopted requiring enrichment.

49. *The public restaurant.* A ready means of improving diets, particularly in low-income urban districts, is the public restaurant under government auspices. Low-cost, simple but adequate meals are served, and prices may be adjusted to the needs by government subsidy. Where much of the food is rationed, such restaurants in industrial districts help to give the necessary elasticity to the food economy, for workers, whose requirements may be greater than average, can satisfy their needs by off-the-ration meals. Public restaurants also afford excellent opportunities for education in correct feeding. They are mentioned in reports of the United Kingdom, Chilean, and Mexican delegations to the Hot Springs Conference and are probably found in many other countries.

50. *Fruit and vegetable gardens.* Mention has been made of vegetable gardens in connection with schools, but they are also an excellent means of supplementing the diet of urban residents—when small allotments are available in the vicinity—and of many other groups. They have been encouraged and planned in the most advanced countries during the war, to provide, near-by sources of the foods most useful in supplementing the average diet, thus safeguarding against local shortages due to transport or other difficulties. But experience has also demonstrated their very great value in the less well-developed countries, where they can be so planned as to provide the nutrients most deficient in the usual diet.

51. In French West Africa experimental gardens have been planted under the authority of the village chief. They consist of grain crops and fruit trees, including mangoes, breadfruit, avocados, guavas, oranges, and lemons. Vegetables with a high protein content—peanuts, cape beans, soya beans, and peas—are also cultivated in these gardens, since the usual diet is deficient in protein.

52. *Diversification of diets.* It is a sound principle of good nutrition that the needed food energy should be derived from a variety of foods. Thus, in underdeveloped countries where it is the custom to rely mainly on one cereal, greater diversification of the diet leads at once to improvement. "A combination of cereals and legumes is strongly to be recommended."¹ Such legumes as the soya bean particularly and the peanut (ground nut) usefully supplement a cereal diet.

NATIVE PRACTICES INCREASING FOOD VALUES

53. Wider use of some of the native practices that increase food values would do much to improve levels of nutrition in less developed countries.

54. In the Netherlands East Indies, for example, legumes form a larger part of the food than in many similar areas since they are prepared in a way that adds to their value and makes them more palatable. They are fermented with molds, a process that debitters soya beans and makes them easy to prepare for eating. In the case of peanuts, digestibility is increased. These *tempes*, as they are called, are thus a very important factor in relation to the nutrition problem.

55. Native beers may provide the vitamin B complex (in the yeast) and vitamin C (from germinated grains). "The use of these beers in moderation has certain benefits from the nutritional point of view whatever may be the other objections to it"².

56. Vegetable oils rich in vitamin A are an urgent need in less developed countries. In this respect unbleached red palm oil serves a most useful purpose, for its vitamin A value equals that of a good cod-liver oil, and there is no great loss of this value in cooking. Another means of developing a good source of vitamin A is the establishment, where feasible, of a local shark-liver oil industry. This was done in India through the joint efforts of nutrition experts and various government agencies.

57. In the tropics sugar is often a principal industry, and much sugar is included in the diet of the people. If refined sugar is

¹Great Britain. Economic Advisory Council, Committee on Nutrition in the Colonial Empire *op cit.*, Part I, Cmd. 6050, p. 95.,

²*Ibid.*, p. 69.

consumed, nothing of nutritional advantage is gained beyond some energy value; on the other hand, sugar-cane syrups and molasses may be important sources of iron—a significant consideration, for it is in these countries that anemia prevails.

58. Far too little is known of the value of native foods and food practices. That something has been learned is due to the work of nutrition scientists, and these are not commonly found in underdeveloped countries. More research on these matters might yield important dividends, and no doubt FAO will encourage this work. FAO should also foster greater opportunities for the training of nutrition scientists from the less developed countries.

IMPROVING NUTRITION AT EXISTING ECONOMIC LEVELS—EDUCATION

59. In the least developed countries, where economic improvement under the best conditions will be slow, it would be a mistake to believe that nothing can be done to improve nutrition until an organized attack is launched against poverty, or measures are taken to raise the standard of living, or a long-term food program has been worked out. In such countries and regions, ignorance is often the worst enemy of health, and the first aim should be to improve nutrition at existing levels of living. "There is no doubt that a properly directed policy could do much to remove malnutrition even at the present economic level."¹ This can be done by education, but the methods must be adapted to the conditions, attitudes, and traditions of the people. In any group it will be found that some families make better use of their food resources than others; by bringing this out in group discussions valuable and lasting lessons may be taught. It is important to educate and secure the active cooperation of local leaders, in and outside of government. For example, tribal chiefs can be extremely useful, as the French authorities learned in Equatorial Africa, when vegetable gardens were started under their auspices. In colonial and similar territories physicians in the medical services are held in high respect by the natives; their cooperation is essential to progress. A good plan would be to have a physician with special knowledge of nutrition visit towns and villages or other centers of population, study the nutrition of children and others in company with local doctors and leaders, and go into related questions, particularly food production, with the appropriate local authorities. A committee of local persons might then be set up, consisting of doctors, local officials, teachers, employers, workers and others who would sponsor and participate in the work, each in his own field, and keep in touch with the national nutrition organization or one of its regional branches. This kind of approach to the problem, on which Hot Springs and the League's Mixed Committee placed so much emphasis, needs to be carried into towns, villages, and remote settlements, as well as to the seat of government. This is particularly true of less developed countries where means of transport and communication are poor.

60. Since the bearing of nutrition on health and efficiency has only recently begun to be understood, ignorance and occasionally prejudice concerning it "is not confined to those who are themselves undernourished," but "exists also among those who have power over the nutrition of others, government officials, members of Legislative Councils, employers of labor, education authorities, missionaries."² The

¹*Ibid.*, p. 104.

²*Ibid.*, p. 104.

fundamental importance of securing the enlightened cooperation of such leaders cannot be overemphasized.

NEED FOR CLASSIFICATION OF COUNTRIES AND REGIONS

61. At first glance the wide range of social, economic, political, and ethnological conditions in various countries and regions of the world is likely to confuse those whose business it will be to plan for better human nutrition. For this diversity holds true within countries, provinces, and smaller subdivisions; it extends also to single villages or settlements, where there is often a wide spread between low and high incomes which shows itself in a variety of housing, occupations, diets, medical care, habits, and customs. Looking at the problem of nutrition from a world point of view, it would seem that the confusion caused by the wide variations in conditions under which nutrition policy must be applied would be clarified by the classification of regions and peoples of the world into regions and groups with similar characteristics as regards the possibility of improving nutrition and the means of bringing this about. Classifying regions and groups according to conditions and needs would be most helpful to national nutrition authorities, for the measures that experience has shown are most helpful in each such region or group could be selected out and applied without a delay. Such classification transcends the scope of this report since it must be based on many other factors besides nutrition, but it should be one of the early responsibilities of FAO. The basic information necessary for classification, and indeed for all other nutritional purposes, is most lacking for regions and peoples of the world where the need for better nutrition is greatest. But if we rely upon the opinion of the most experienced nutrition authorities, no government need hesitate because of the lack of this information, for considerable nutritional improvement can be brought about quickly even in the poorest countries at existing economic levels. Raising even a little the food consumption levels of some of its people will improve the status of a nation's health—and ill health is an important cause of poverty, national as well as individual.

3. APPROACH TO BETTER NUTRITION THROUGH FORMS OF ORGANIZATION REPRESENTING THE COMPLEX INTERESTS INVOLVED

62. The obvious need for greater knowledge in almost every field relating to nutrition—dietary requirements under varying conditions; the composition of foodstuffs in different parts of the world; the relation of nutrition to health as well as its effect upon resistance to disease, efficiency, and longevity; the basic causes of dietary habits; the best methods of changing food habits; losses in nutrients and other alterations in foods resulting from storage, drying, fermentation, and processing—is an obvious challenge to the physician, food scientist, administrator, and educator.

63. As regards means of satisfying the appetite, men eat, in different parts of the world, a wide variety of foods including plants of many kinds, grubs, earthworms, wood lice, caterpillars, rats, locusts and flying ants, oysters, caviar, and the most refined and often nutritionally impoverished products of the food technologist's art. Variation in methods of preparation is almost as great. Yet scientific advance has revealed the common threads in the fabric of human

nutrition. However numerous the foodstuffs used, it is their content of a few essential nutrients which is important. However wide the variations in human nutrition, those whose food most nearly supplies them with scientifically assessed nutrient allowances are the best nourished and the most healthy. Moreover, methods of improving dietary levels are basically few and simple, however difficult some of them may be to apply in practice. The approach to problems of nutrition is also simple, although it may lead to work in many different fields. For the improvement of dietary levels depends in the first instance upon knowledge of dietary habits and nutritional status. Such knowledge is never complete in any country, yet a little knowledge may suffice to make a good start in an underdeveloped country. For example, the fact that the staple diet of the people in a given region is polished rice, and that they suffer from beriberi, should bring at once into play some of the following measures.

64. For the long run, greater diversity of the diet needs to be encouraged and this will require experimentation and education. If beriberi prevails, medical treatment will be needed as well as certain prophylactic measures such as the distribution of fresh vegetables, whole-wheat bread, or dry yeast. Since good nutrition depends upon the availability of proper foods, agriculture, marketing and processing, prices, and wages must be taken into consideration. The different parts fit neatly into the picture, but the picture is never complete if any of the parts are overlooked. Basically, this is the argument for an integrated approach so essential to the solution of the problem, which is exemplified by the setting up of national nutrition committees, councils, or organizations. So much useful work followed the creation of such organizations in many countries between 1936 and the present that they can be confidently recommended to governments as a first step in the campaign for better nutrition. This will not delay but expedite needed action, and ensure that such action is suited to the occasion and the circumstances.

NEED FOR A NATIONAL NUTRITION ORGANIZATION

65. The League's Mixed Committee used the following arguments to support its recommendation that every government should set up a national nutrition council. Advantage must be taken of the natural tendency toward better nutrition by consciously directing it toward definite goals. The problem of nutrition is a many-sided one, since economic and social action must be coordinated with the latest physiological teaching. The Mixed Committee believed that its own usefulness had been due largely to the fact that it was made up of persons of diverse experience who had viewed the problem of nutrition from the angles of health, labor, agriculture, economics and finance, social welfare, cooperation, or administration. Both Hot Springs and the Mixed Committee declared that the most important task of these organizations was to formulate national nutrition policy based upon studies of food consumption habits and the nutritional status of the population.

66. The early establishment of such organizations would facilitate the cooperation of governments with FAO and enable them to benefit more greatly from its work. For they are to "exchange information and experience and provide mutual assistance, both directly when desirable and through FAO."

EXAMPLE OF A NATIONAL NUTRITION ORGANIZATION

67. National nutrition organizations, while well suited to the conditions in highly developed countries, are of paramount importance in the underdeveloped countries. As an illustration, the Committee has chosen the organization and work of the National Nutrition Council of the Union of South Africa, since this is one of the latest to be set up, and since it has had to cope with such a wide variety of conditions ranging from metropolitan societies of Western type to tribal life among African natives.

68. According to a recent census, the Union of South Africa has a population of 10,251,000 of which 2,135,000 or 21 percent are European, 233,000 or 2 percent Asiatic, and 7,883,000 or 69 percent Bantu. The balance, amounting to about 8 percent, is primarily Cape colored. Natives constitute the majority of the population of all areas.

69. The establishment of a National Nutrition Council in South Africa "came as a direct result of the interest in nutrition which the League of Nations had aroused and stimulated throughout the world since 1935."¹

70. The first nutrition survey, in 1938, "unfortunately proved the existence of malnutrition in a large percentage of the school-going population." The surveys were then extended and an attempt made "to secure evidence on causative and correlative factors in medical, agricultural, economic, and social fields"² Feeling that the complexity of the problem demanded a more comprehensive approach than was possible for a single department, an amendment to the Public Health Act was passed in 1940, setting up a National Nutrition Council "to investigate and report to the Minister of Public Health upon all matters relating directly or indirectly to the prevention of malnutrition in and the improvement of the diet of the inhabitants of the Union, which in its opinion should be investigated or which the said Minister may refer to it for investigation."

The Council consists of twenty-one members and six alternates, there being twelve government and nine nongovernment members. The government members are high officials, mainly secretaries of departments concerned with any aspect of food and nutrition. The nongovernment members represent medical research, universities (economics, social studies, and medicine), agriculture, native interests, voluntary health agencies, and parliament.

71. Soon after it was set up it became clear that the Council could not function effectively without the help of a technical secretariat. Accordingly, the government set up a Nutrition Section in the Department of Public Health, staffed with a nutrition officer, dietitians, and administrative personnel. The section acts as a clearinghouse for information on nutrition and cognate subjects, keeps in touch with all nutritional research work proceeding in South Africa, and acts as technical secretariat for the Council and its several committees.

¹Union of South Africa Department of Public Health, *First Report of the Activities of the National Nutrition Council for the Period 27th June, 1940, to 31st December, 1943*, Pretoria, 1944, p. 1.

²*Ibid.*, p. 1.

72. The setting up of the National Nutrition Council was the signal for great activity on the food and nutrition front throughout the country. Nutrition surveys became more numerous and extensive ; army rations were studied and improved ; measures were recommended to improve the diet of civilians, including natives ; research in foods was greatly stimulated ; a national scheme for school feeding was proposed ; the value of new foods, such as food yeast, was investigated ; and proposals were made for the utilization of surplus foods, such as citrus fruits, in the interests of better nutrition.

73. The Council is a purely advisory body, final responsibility for nutrition policy being left, as is proper, to the government of the day. Nevertheless, the results of its research into dietary habits, nutritional status, and composition of foods are positive contributions to knowledge and form the basis for any sound food and nutrition program. Private effort is stimulated and coordinated even if the government should find it difficult fully to carry out the recommendations of the Council.

ADVANCES IN NUTRITION SHOWN TO BE POSSIBLE UNDER ADVERSE CONDITIONS

74. In the world as a whole and particularly in the underdeveloped countries the picture of malnutrition is a black one. Advances in our knowledge tend to increase the percentage of those we classify as deficient nutritionally since we have learned to recognize many of the previously unknown effects of diets short in one or several of the essential nutrients. As more surveys are carried out in the less developed countries and in the least developed regions of advanced countries, greater percentages of malnutrition are found to exist.

75. Yet the picture has its brighter side, based also on advances in our knowledge of nutrition. In the United Kingdom during the war nutritional advance took place in spite of a reduction in food resources, and the results in health have been directly contrary to those experienced during World War I. After five years of war, infant mortality has declined to new low levels. This has also been true of death rates at ages from one to ten years. Deaths from tuberculosis have not exceeded the low record of the best previous prewar year. Stillbirths have declined and fewer mothers have died in childbirth. Life expectancy at all ages among civilians has not been reduced during the war in spite of the deaths from bombing. These achievements, which would have been remarkable even in peacetime, are clearly related by the Chief Medical Officer of the Ministry of Health to the national food policy which was particularly directed to the lower income and otherwise vulnerable groups. For it is among these groups that infant mortality is highest, that tuberculosis exacts its greatest toll, that premature death strikes most frequently. Measures to ensure that an adequate diet was available to all members of such groups have been the instruments of these results, for during the war all other environmental conditions deteriorated. If such simple and relatively inexpensive measures can bring about such striking results in wartime, how great must be the promise held out by similar nutritional advances in peacetime ? Close collaboration in matters of food between the principal United Nations was one of the factors which

made these results possible. The closer international cooperation in many fields which we have every reason to anticipate after the war is over should make the problem of nutrition easier to solve for every government.

76. Results similar to those in the United Kingdom were experienced by the United States of America and Canada and doubtless by other countries. We turn now to a closer examination of the food programs and policies of these three countries to discover the measures and methods likely to be as effective in peacetime as they have been during the war in promoting human health and welfare through better nutrition.

PART II. FOOD MANAGEMENT IN WARTIME

1. RESTRICTION OF PART II TO TREATMENT OF FOOD MANAGEMENT IN CANADA, THE UNITED KINGDOM, AND THE UNITED STATES

77. When the Technical Committee began its work it hoped to prepare an account of the nutrition policies and wartime food programs in a number of different countries. It soon appeared that it would not be possible to collect in time the information required for such a report. Information on nutrition and food management in Canada, the United Kingdom, and the United States of America could be obtained readily. Far more serious food and nutrition problems are to be found in many of the underdeveloped countries, but the Committee soon learned that it would be virtually impossible in wartime to collect the necessary data. Accordingly, it was found necessary to restrict this part of the report to three countries, anticipating that the task of extending it to the many other countries with more serious food and nutrition problems would be undertaken by FAO at an early stage.

2. COMMON NUTRITIONAL RESULTS OF WAR

78. Inflation of food prices, decreased supplies, malnutrition, disease, and famine have been in the past the usual nutritional concomitants of war. But in this war most belligerent governments have been unwilling to let history repeat itself, and they have intervened to secure optimum use of food resources as a means of maintaining health, working efficiency, and morale.

79. In the United States of America, the United Kingdom, and Canada both the wartime objectives and the types of governmental guidance and control have been similar in principle, but control has gone much further in Great Britain. In all three countries there has been reduction and strict control of food imports, greatly increased production and control of agriculture, and control of the uses to which food is put on the farm and in the factory.

80. The United States and Canada have been able amply to maintain the average prewar civilian food consumption levels and at the same time substantially to increase food exports to their Allies, to allocate ample supplies to the armed forces, and also to increase other noncivilian food uses. The United Kingdom has, by improved use of considerably reduced food resources, been able to maintain an adequate average supply of essential nutrients, but the consumer has had to accept a diet which by prewar standards lacks palatability and variety and is in some respects marginal.

81. In all three countries there were, before the war, many people who through poverty or ignorance had inadequate diets. Malnutrition was particularly common among the vulnerable groups with high physiological needs for the more expensive foods. During the war, malnutrition amongst these groups has probably decreased in the

United States and Canada and has substantially decreased in the United Kingdom. It follows that the wartime experience in food management of these three countries should be of wide general interest and value.

3. EXAMINATION OF PREWAR AND WARTIME DEVELOPMENTS

DEFINITION OF FOOD MANAGEMENT

82. Food management¹ is the technique of making the best use of food production and distribution to satisfy nutritional needs. Nutrition is the science that defines these needs and the adequacy of individual foods or diets to meet them.

EVOLUTION OF FOOD MANAGEMENT

83. For most governments food management in wartime has involved intervention in relatively new social and economic fields. But their experience shows, as never before, that the achievement of good nutrition calls for a broad approach, integrating the knowledge, interests, and operations of producers, consumers, administrators, scientists, educators, and commercial groups. Their experience has created new administrative techniques which have great potentialities for the improvement of nutrition and for the betterment of living conditions in the coming peace.

INTERIM CHARACTER OF REPORT

84. The interim character of this report must be emphasized. The war is not yet over; the United Nations have as yet only limited experience of the nutritional and administrative problems of food relief; detailed information concerning the policies and problems of enemy and enemy-occupied countries is lacking; the long-term effects of wartime conditions on morbidity and mortality, on nutritional status, and on dietary habits are not yet clear. Abnormal food conditions may be expected to persist for several years, and during that time experience will continue to accumulate. Before the experience already gained and the experience still to come can be fully appreciated, it will be necessary to see it all in a quieter and more distant perspective; meanwhile it is important that steps be taken to secure in every country full recording and analysis of wartime experience in agriculture, food, and health.

INTEREST TO WESTERN COUNTRIES OF WARTIME EXPERIENCE IN CANADA, THE UNITED KINGDOM, AND THE UNITED STATES

85. In the United States and Canada the governments have found it necessary to exercise a partial control over their whole food economy from the soil to the consumer in order to secure effective prosecution of

¹Since food management represents an integrated approach to the improvement of human nutrition, it follows that reference must be made to food production as well as to food consumption, with which this report is primarily concerned. For more detailed information the reader is referred to *Agricultural Production—Report of the Technical Committee on Agricultural Production*.

their war effort, which necessarily includes aid to their Allies. Although this study is limited to these three countries it is clear that their central problem, that of making the best economic and nutritional use of food resources, is common to all countries, and that between them these countries provide examples of many types of temperate and subtropical climate and farming. They show a wide range of food economies from undeveloped subsistence farms to highly advanced metropolitan communities, and from areas where population is pressing on food supplies to well-to-do groups in whose diets the more expensive protective foods feature largely. Finally, one of these countries (United Kingdom) is a large food importer, one (United States of America) imports as much food as it exports, while the third (Canada) is a substantial food exporter.

86. The broad similarities between the fundamental problems and the way they have been tackled in countries with such differing geographic, agricultural, economic, and social backgrounds suggest that their wartime experience should be of interest and value to most Western countries. Further, since the problems of nutrition and food management are fundamentally the same in most countries with an exchange of money economy, the results of such a study should assist government that will soon be attempting to frame their postwar policies and adapt them to the recommendations of the Hot Springs Conference. Finally it is to be hoped that this account of food and nutrition policies in these countries during the war will stimulate the preparation of similar reports on other countries.

4. WARTIME PROBLEMS IN FOOD MANAGEMENT

TRENDS OF NUTRITION BETWEEN THE TWO WARS ADVANCES

87. Although the importance of "accessory food factors" had been established and the word vitamin coined before 1914, the last war was fought with totally inadequate understanding by governments of the functions of food in war. The results in malnutrition, reduced industrial output, disease, and death, undoubtedly proved an incentive to the postwar wave of nutritional research. By the early 1930's the "newer knowledge of nutrition" enabled scientists to postulate the body's need for minerals and some of the vitamins in quantitative terms and to say which foods were rich and which poor in these essential nutrients.

88. The world-wide depression revealed the specter of poverty in the midst of plenty. Interest was stimulated in methods by which unemployed and other low-income consumers could be better fed by measures that increased the demand for farm products. The depression emphasized that poverty is a major cause of malnutrition and ill health, that good diets tend to be more expensive in cash, labor, and land than poor diets, but that there is ample room everywhere for dietary improvement by better utilization of existing food resources—internationally, nationally, and in the home. The Mixed Committee investigated the possible "marriage of health and agriculture", and published a series of technical reports, one of which¹ crystallized

¹League of Nations, Mixed Committee on the Problem of Nutrition, *op. cit.*

out of national experiences the bases of what is now called food management.

89. While these advances in appreciation of the importance of good nutrition and of its relation to economic and agricultural problems were taking place among national leaders, administrators, and the general public, there were in operation certain long-term trends that indirectly favored the improvement of nutritional levels, particularly in Western countries. These included :

(1) The trend toward increase in real national incomes, mainly due to improvements in skill, equipment, and technique in economic affairs, but limited by various important international, economic, and monetary factors.

(2) The increasing technical efficiency (mainly the result of science, invention, and education) in food production, processing, and transport which was slowly reducing the real cost of food. This was true both of the staple foods and of the perishable foods, such as milk, meat, fruit, and vegetables, which are costly to produce and market and the consumption of which was steadily increasing.

(3) The increase of social services including unemployment insurance and feeding programs for vulnerable groups ; these were securing a somewhat more equitable distribution of real national income, thus helping the lower income groups to obtain better diets.

(4) The general attack on the social environment through better education, improved sanitation, better cooking facilities, and rehousing.

(5) Increasing food consciousness as a result of the phenomenal advances in nutritional science between the wars and the publicity based thereon.

(6) The increase in medical knowledge and its application to maternal and child health programs, to control of disease, and to other public health problems.

RETROGRESSIONS

90. On the other hand, some trends had unfavorable effects upon the character of the diet. Among these were :

(1) The tendency to greater refinement of foods such as grain products, thus reducing the quantities of some of the nutrients that are greatly needed in the diet.

(2) The increase in retail services, in fancy packaging, advertising, and other merchandising methods for promoting sales of food products which in some cases added unnecessarily to their cost.

(3) The great increase in the number and kinds of articles and services on which consumers spend money, frequently at the expense of food.

(4) The increase in employment of women outside the home ; it is questionable whether the additional family income compensates for some of the undesirable results—less time for the buying and preparation of food, for the care and feeding of children, and for household management.

POSITION AT OUTBREAK OF WAR

91. In line with the general trend toward improved health and physique, the nutritional status of civilians in most Western countries probably was higher at the outbreak of the present war than it was in 1914-1918. The administrative machinery built up in practically every country to mitigate the effects of the slump together with the rapid inter-war advance in nutrition and allied sciences enabled governments to face the food problems of this war in the belief that they could at least avoid the errors of the last.

THE WARTIME PROBLEM

92. In wartime, the increased demand for raw materials and shipping and transport for war purposes, together with losses by enemy action and a shortage of labor in civilian industries, reduces the quantity of goods available for civilians. At the same time increased employment and higher earnings create a greater demand for consumer goods. Unless preventive measures are taken, this pressure of increased purchasing power upon a greatly reduced supply of goods results in an inflationary spiral of rising wages and prices.

93. Such inflation adversely affects the living levels and indirectly the nutrition and health of those with low incomes. Consequences are particularly serious for childbearing women and children in low-income families, groups that have the greatest physiological need for certain relatively expensive foods. However, in households with a high proportion of earners to nonearners, diets may tend to improve during moderate inflation, provided family earnings keep ahead of prices. This is particularly true where previous incomes were too low to permit adequate food expenditure.

LOCALIZED SHORTAGES AND GLUTS

94. The diversion of shipping and transport facilities to military uses, their destruction by enemy action, or their disruption by strategic necessity may not only destroy food stocks and limit production, food processing and storage facilities, but may cause acute shortages of particular foods in some areas and equally acute surpluses of the same foods in others. Thus, early in the war the United Kingdom was short of meat at the same time that Australia and New Zealand faced a glut because their principal customer could not spare enough shipping. These shortages or surpluses and the resulting economic or nutritional dislocation are accentuated by the slowness with which the consumer changes food habits, the difficulty of quickly adjusting agricultural production, the decrease in the extent and reliability of trade information from other countries, and the general commercial uncertainty.

95. In surplus-producing areas disruption of a country's normal food economy may cause agrarian distress and possibly waste of food and other national resources, but not usually increased malnutrition. In

importing areas the consequences, unless government intervenes, are more serious. Shortages of food in general or even of particular foods lead not only to inadequate diets, but to hoarding, speculation, and social unrest, while the consumer devotes to the getting of food time and energy which would better be employed in the war effort.

THE PENALTY OF FAILURE

96. If conditions become worse, the city dweller is the first to suffer. Farm dwellers and the inhabitants of small country towns, being nearer the sources of production, get first pick of supplies. The increasing food shortage in the cities would lead either to malnutrition or to migration to rural areas—a movement that clogs military transport, reduces war production, and increases health problems. Finally, as the destructive and disruptive effects of war pile up, famine and the epidemics associated with famine supervene.

97. During World War I all these adverse factors were in operation. This period, as the Mixed Committee stated, “afforded a striking demonstration of the effects of a deterioration in diet, when other factors (housing, sanitation, medical knowledge, etc.) were practically unchanged. The general death rate, and especially the death rate from tuberculosis—a still more sensitive index of nutrition conditions—rose in all countries (belligerent and others) where food restrictions were imposed on the population. The greatest rise occurred when and where the restrictions were most severe. The food producer on the land suffered less than the city dweller because he could always keep some food-stuffs for his own use.....In Germany, while the rise in the tuberculosis death rate from 1914 to 1918 was but 23 percent in the agricultural State of Bavaria, it was as much as 65 percent in Berlin. In Roubaix and Tourcoing, two industrial towns of occupied northern France, the rates rose by 101 percent and 183 percent, respectively.”¹

WARTIME FOOD MANAGEMENT PROGRAMS IN CANADA, THE UNITED KINGDOM, AND THE UNITED STATES

GENERAL CONSIDERATIONS

98. A review of wartime food management in the United States, the United Kingdom, and Canada reveals that the similarities are more striking than the differences. In each country the aim has been to secure the optimum use of food resources in the prosecution of the United Nations' war effort. In each, this has meant reduction and strict control of food imports and greatly increased output from and control of agricultural production. In all three countries governments have to a greater or lesser degree controlled the use which is made on the farm and in the factory of home-produced and imported food products. In order to ensure efficient utilization of total food resources, governments have had to decide how much food should be allocated to livestock, human beings, and industry, while a wide range of scientific and technical problems has been tackled on broadly similar lines. In all three countries rationing and price control have become important features of the wartime food economy. To secure the desired shifts in agricultural production, to prevent undue rises in the cost of food to the consumer, to check inflation, and to give governments sufficient

¹League of Nations, Mixed Committee on the Problem of Nutrition, p. 28.

flexibility of control to meet the exigencies of war, subsidies, "support" prices, and government trading have become the economic foundations of the food program in each of these countries. All of this, combined with the need to save and allocate labor, transport, and other nonfood resources used in the food production and distribution, has necessitated both the control and the cooperation of the farmer, the food manufacturer, the food distributor, and the consumer. It has involved the planning of national dietaries to fit national food requirements and food resources. Thus, a fully or partly controlled food and agricultural economy has proved essential to the war effort in all three countries. This control has proceeded further in the United Kingdom, which before the war imported more than half its food supplies and was thus in a vulnerable position, than in the United States and Canada, which are food-exporting countries. Although the greater severity of the control in the United Kingdom has been associated with positive nutritional gains, in spite of a reduction of food supplies, it is probable that with the return to normal conditions much of this control will be abandoned. Thus, from the point of view of peacetime, the experience of the United States and Canada where control has been less severe may be just as valuable as the striking nutritional developments in Great Britain.

99. There are many indications that in Germany and Occupied Europe the problem of making the best use of food resources has been tackled in broadly the same way. Hence this study of the instruments used in food management should prove of general interest in Western countries.

PREWAR POLICY AND SITUATION

100. Before the present war the food supplies of the United Kingdom; the United States, and Canada were largely determined by the free play of supply and demand as modified by fiscal and agricultural policies, which were not substantially influenced by nutritional considerations. The average supplies of food energy, protein, and fat were in each country well above requirements. (See Tables 1-3 in text and 1-5 in Appendix I.) In the United States there were over-all shortages of several nutrients by comparison with the recommended allowances of the Food and Nutrition Board of the United States National Research Council—certainly in calcium and riboflavin and probably in thiamine and ascorbic acid. In the United Kingdom calcium was in short supply by the same criterion, and there was only marginal adequacy in vitamin A, thiamine, ascorbic acid, and riboflavin. In Canada the average intake of calcium, riboflavin, and ascorbic acid was below these recommended allowances.

101. Compared with most other countries, food consumption in these three countries was high. Yet the diets of at least one third of the population of each country were obviously inadequate because of ignorance, poverty and its associated apathy, and other similar causes. In each country the diet of the individual or family was determined, within the framework of food habits, primarily by income and only secondarily by physiological need. Thus, although at the outbreak of war these three countries had a high standard of living and food supplies which, on the average, exceeded calculated requirements of most nutrients, yet they also had substantial malnutrition, especially amongst the lower income groups.

TABLE 1. ESTIMATED SUPPLIES, IN POUNDS PER CAPUT PER YEAR, MOVING INTO CIVILIAN CONSUMPTION, UNITED STATES, CANADA, AND UNITED KINGDOM, PREWAR AND 1943

Item	Supplies, prewar			Supplies, 1943*			Percentage change, 1943, compared with prewar			Supplies, 1943, in United Kingdom as percent of		Supplies, 1943, in Canada as percent of United States
	United States	Canada	United Kingdom	United States	Canada	United Kingdom	United States	Canada	United Kingdom	United States	Canada	
Milk and milk products, excluding butter, total milk solids (fat and nonfat) ...	55.5	58.1	38.3	65.5	67.6	49.0	+18	+16	+28	75	72	103
Meats, including cured, canned, and edible offal (as carcass weight) ...	134.1	119.6	132.8	148.8	154.2	107.7	+11	+29	-19	72	70	104
Poultry, game, and fish (edible weight) ...	25.4	25.8	31.1	28.5	31.4	22.0	+12	+22	-29	77	70	110
Eggs (fresh equivalent) ...	34.7	30.5	24.4	38.9	35.3	21.6	+12	+16	-11	56	61	91
Oils and fats (fat content) ...	44.7	41.2	45.6	43.2	43.4	38.2	-3	+5	-16	88	88	100
Sugars and syrups (sugar content) ...	106.7	103.3	109.7	93.4	88.6	71.9	-12	-14	-34	77	81	95
Potatoes and sweet potatoes ...	144.6	195.9	177.2	144.4	206.2	272.9	.....	+5	+54	189	182	143
Pulses (beans, peas, and lentils) and nuts (weight without shell) ...	14.6	12.5	9.6	18.3	11.5	6.3	+25	-8	-34	34	55	63
Tomatoes and citrus fruits (fresh fruit equivalent) ...	100.9	58.5	46.8	127.1	74.4	20.7	+26	+27	-56	16	28	59
Other fruits and fruit products (fresh equivalent) ...	164.4	80.7	93.4	125.2	74.8	59.0	-24	-7	-37	47	79	60
Leafy, green, and yellow vegetables ...	91.0	41.8	77.5	106.6	40.3	113.3	+17	-8	+46	106	281	38
Other vegetables ...	95.5	34.0	45.2	107.1	25.9	65.2	+12	-24	+44	61	252	24
Grain products ...	199.4	206.9	211.0	207.6	224.5	247.7	+4	+9	+17	119	110	108
Beverages (tea, coffee, cocoa) ...	19.1	10.8	14.7	16.5	9.0	11.9	-14	-17	-19	72	132	55

SOURCE: Combined Food Board, Special Joint Committee, *Food Consumption Levels in the United States, Canada and the United Kingdom*, Second Report, December 1944.

NOTE: The figures in the above table are national averages and should not be taken to represent the actual supply received by each individual consumer.

*Including Victory-garden production.

TABLE 2. ESTIMATED SUPPLIES, PER CAPUT PER DAY, OF NUTRIENTS AVAILABLE FOR CIVILIAN CONSUMPTION, UNITED STATES, CANADA, AND UNITED KINGDOM, PREWAR AND 1943

Item	Unit	Supplies, prewar			Supplies, 1943			Percentage change, 1943, compared with prewar		Supplies, 1943, in United Kingdom as percent of		Supplies, 1943, in Canada as percent of United States
		United States	Canada	United Kingdom	United States	Canada	United Kingdom	United States	Canada	United States	Canada	
Calories	Number	3236(3080)	3182(3080)	2987	3342(3190)	3401(3300)	2861	+3	+7	86(90)	84(87)	102(103)
Protein, animal	Grams	51	51	43	59	62	41	+15	+22	69	66	105
Protein, vegetable	"	38	39	38	40	42	47	+7	+6	117	113	103
Total protein	"	89	90	80	99	104	88	+12	+15	89	85	104
Fat	"	129	124	129	139	140	114	+8	+13	82	81	101
Carbohydrate	"	430(391)	427(402)	376	424(386)	431(406)	372	-1	+1	88(96)	86(92)	102(105)
Calcium	Milligrams	885	879	683	1008	1011	1045	+14	+15	104	103	100
Iron	"	14	15	12	16	17	16	+15	+13	100	96	104
Vitamin A	Int. Units	6804	6162	3831(4700)	7355	6242	3694(4800)	+8	+1	50(65)	59(77)	85
Ascorbic Acid (vitamin C)	Milligrams	105	60	101	114	65	117	+8	+8	103	180	57
Thiamine (aneurin) or vitamin B ₁	"	1.8	2.0	1.2(1.4)	2.5	2.4	1.9(2.1)	+41	+21	77	81	95
Riboflavin	"	2.0	1.0	1.6	2.3	2.2	2.1	+18	+17	88	92	97
Niacin (nicotinic acid)	"	16	17	18	19	21	19	+18	+20	101	90	112

SOURCE: Combined Food Board, Special Joint Committee, Food Consumption Levels in the United States, Canada and the United Kingdom, Second Report, December 1944.

NOTES: (a) The figures in the above table are national averages and should not be taken to represent the actual supply received by each individual consumer. No allowance has been made in the above figures for the substantial losses of some nutrients which may occur in storage, preparation, and cooking. (b) The figures in parentheses following those for calories and carbohydrates (United States and Canada) and for vitamin A and thiamine (United Kingdom) indicate the approximate value if calculated with the same nutrient factors as for other countries. For these nutrients the methods of estimation in the three countries are not entirely comparable. For other nutrients this difficulty does not arise and the figures may be regarded as comparable.

TABLE 3. RECOMMENDED DIETARY ALLOWANCES OF THE UNITED STATES NATIONAL RESEARCH COUNCIL AND WEIGHTED PER CAPUT ALLOWANCES FOR THE UNITED STATES, CANADA, AND THE UNITED KINGDOM

Item	Recommended daily allowance										Niacin (Mg.)
	Calories (No.)	Protein (Gm.)	Calcium (Gm.)	Iron (Mg.)	Vitamin A (I. U.)	Thiamine (Mg.)	Ascorbic acid (Mg.)	Riboflavin (Mg.)			
Children :—Under 1 year	900	36	1.0	6	1,500	0.4	30	0.6		4	
1-3 years	1,200	40	1.0	7	2,000	.6	35	.9		6	
4-6 years	1,600	50	1.0	8	2,500	.8	50	1.2		8	
7-9 years	2,000	60	1.0	10	3,500	1.0	60	1.5		10	
10-12 years	2,500	70	1.2	12	4,500	1.2	75	1.8		12	
Boys:—13-15 years	3,200	85	1.4	15	5,000	1.6	90	2.4		16	
16-20 years	3,800	100	1.4	15	6,000	2.0	100	3.0		20	
Girls:—13-15 years	2,800	80	1.3	15	5,000	1.4	80	2.0		14	
16-20 years	2,400	75	1.0	15	5,000	1.2	80	1.8		12	
Men (21 years and over) :—Sedentary	2,500	70	0.8	12	5,000	1.5	75	2.2		15	
Moderately active	3,000					1.8		2.7		18	
Very active	4,500					2.3		3.3		23	
Women (21 years and over):											
Sedentary	2,100	60	0.8	12	5,000	1.2	70	1.8		12	
Moderately active	2,500					1.5		2.2		15	
Very active	3,000					1.8		2.7		18	
Pregnancy (latter half)	2,500	85	1.5	15	6,000	1.8	100	2.5		18	
Lactation	3,000	100	2.0	15	8,000	2.3	150	3.0		23	
United States :—Average (full) intake requirement	2,531	65.2	.94	11.7	4,560	1.45	70.7	2.1		14.5	
Average (restricted) intake requirement...	2,531	65.2	.79	9.6	3,650	1.2	58	1.7		11	
Canada :—Average (full) intake requirement	2,544	66.1	.96	11.8	4,590	1.45	71.3	2.1		14.5	
Average (restricted) intake requirement	2,544	66.1	.85	9.6	3,750	1.17	59.1	1.7		11.7	
United Kingdom :—Average (full) intake requirement	2,546	64.6	.91	11.7	4,664	1.47	71	2.2		14.7	
Average (restricted) intake requirement	2,546	64.6	.75	9.3	3,660	1.1	57	1.7		11	

SOURCE: U. S. National Research Council, *Recommended Dietary Allowances*, January 1943; and Combined Food Board, Special Joint Committee, *Food Consumption Levels in the United States, Canada and the United Kingdom*, Second Report, December 1944.

NOTES: (a) The requirements of children under 1 year in the United Kingdom have been approximately covered by assuming that the number of nursing mothers is roughly equal to that of this group of children. (b) For the purpose of the Combined Food Board inquiry all adult men and all adult women other than expectant and nursing mothers have been classified as moderately active. (c) Allowances used: The average (full) intake requirements are calculated on the allowances recommended by the National Research Council of the United States. The average (restricted) intake requirements are the same as the average (full) intake requirements, except that the requirements of minerals and vitamins for adult men and for adult women other than expectant and nursing mothers have been calculated as 70 percent of the average (full) intake requirements.

102. Malnutrition was on the decrease, however, partly because special schemes for vulnerable groups were growing, partly because social security measures were becoming increasingly important, and partly because long-term favorable economic, [scientific, and technical trends were making more, better, and relatively cheaper food available. In the United States, for instance, consumption per head of milk, citrus fruit and green and yellow vegetables had increased markedly since 1920, while consumption of grain products (particularly white flour) and potatoes had declined. Comparable trends existed in the United Kingdom and Canada.

103. During the war food exports from the United States and Canada have increased rapidly, while imports into the United Kingdom have declined severely. Yet, in spite of much greater exports, diets in the United States and Canada appear to have improved and the incidence of malnutrition to have fallen. Because of the lack of continuous surveys of food consumption and nutritional well-being some uncertainty attends this statement. However, in the United Kingdom such surveys have revealed that the average nutritional status has been maintained, and in some respects improved, although not without hardship to the consumer and unwelcome dietary changes. In the United Kingdom certainly, and probably also in Canada and the United States of America, malnutrition among the lower income and vulnerable groups has decreased. How have these results been achieved?

OBJECTIVES OF FOOD PROGRAMS

104. The objectives in each country have been broadly similar. They may be epitomized by a statement of the official United States aim :

(1) To use in the production and distribution of food such quantities of the nation's total resources as can contribute more to the war effort in this employment than they could in any alternative employments.

(2) To use these resources with the maximum efficiency in supplying the kinds and quantities of commodities that yield the highest returns in terms of essential needs.

(3) To secure a distribution of food internationally among all countries depending upon it in their war effort and internally among all domestic groups, which will ensure the greatest practical equity in sharing and the best use toward winning the war.

105. The aim has been to ensure that in each country each individual or household gets enough of the right kinds of food to maintain health, morale, and working efficiency at wartime pitch, with special emphasis in the United Kingdom on the health, number, and social value of the next generation. To this end (a) the diet must be sufficiently palatable, varied, and consistent with habit to ensure that the individual eats enough to meet his needs, (b) the machinery of distribution must provide fair shares with special allowances to those with special needs ; (c) adequate shopping and catering facilities must be available to all; and (d) prices must permit everyone to satisfy his needs.

SUPPLY PROGRAMS

106. Supply plans must be integrated with requirements. The first step in each country, therefore, has been to estimate the needs of the civilian and the military population, the needs for wartime industrial purposes, and, in the United States and Canada, exports needed by and transportable to Allies. The production program has then been geared to these needs. In the United Kingdom home production has been maximized to release as much shipping as possible and limit vulnerability to enemy action.

107. In the United States the aim has been an over-all increase of farm output with special emphasis on animal products to meet increased military and export requirements and on oils and fats to offset the loss of supplies from the Pacific. In Canada the aim has been to meet military, export, and civilian food requirements by expanding production where existing supplies do not meet wartime requirements. This has resulted in a great increase in the output of animal products, mainly for export. In the United Kingdom the aim has been to reduce demands on shipping by securing maximum output and sale off farms of milk and vegetables, and of energy foods for direct human consumption—wheat and other bread grains, potatoes, and sugar—which produce the greatest output per unit of farm resources. Table 7 in Appendix I shows the changes in agricultural production that have occurred in these three countries during the war.

108. The results in each country have been substantial; they clearly demonstrate the potentialities of agriculture in many temperate countries to meet, in peacetime, the higher food demand which the Conference at Hot Springs pointed out would flow from sound nutrition programs and an expanding world economy. Tables 1 to 6 in Appendix I show the quantities of nutrients available for civilian consumption from each of the major food groups in 1943 and in the prewar period, in the United States, the United Kingdom, and Canada.

109. In 1943 United States food production was one third greater¹ than in 1935-1939, three quarters of this increase being absorbed by military needs and exports to Allies. In Canada production was more than 25 percent above prewar levels. In the United Kingdom farmers produced before the war 30 percent of the country's food energy and two thirds of its animal protein, as well as the greater part of its protective foods. Today they produce nearly half the United Kingdom food energy requirements, but the output of animal protein had declined, mainly because the number of pigs and poultry has fallen roughly by two thirds and one third, respectively, while the production of milk has been put before that of beef and sheep. This decline has been, in part, made good by imports of animal products, particularly from North America. In all three countries vegetable gardens have been encouraged and have undoubtedly contributed substantially to the supply of vegetables available to civilians.

AGRICULTURAL PROGRAMS

110. Price incentives, persuasion, and, in the United Kingdom, some compulsion have been the main instruments by which these programs

¹As measured by quantities of food produced for sale and for farm home consumption weighted by farm prices in the fixed base period 1935-1939.

have been effected. In each country, national crop and livestock goals are divided into state, provincial, or regional targets, then into county programs, and finally into individual farm schedules. These programs are carried to the farmer and to the food trades through special wartime local organizations, in conjunction with the local extension, advisory, and administrative machinery that existed before the war. But propaganda, persuasion, and technical advice can achieve little unless farm incomes are adequate, farmers confident, and prices adjusted to secure desired shifts in production and to stimulate production, processing, and distribution of needed foods. Hence, in the United States, government-financed "support" prices for basic crops and needed livestock are generally announced before crops are planted and, to some extent, before farmers make their livestock plans. In the United Kingdom there are fixed prices and guaranteed markets for the bulk of the farmer's output for one or more years ahead. To honor this policy, to eliminate black markets, and to facilitate rationing, the government actually buys some of the farmer's production and is ready to act as marginal buyer in case of need. In addition, acreage subsidies are used for such direct food crops as wheat and potatoes. In Canada acreage subsidies have been used to divert land from wheat to feed grains for livestock while government-supported minimum prices, subsidies, and, in some cases, fixed prices now extend to most of the products the farmer sells.

IMPORT PROGRAMS

111. Before the war the major food imports into the United States were tropical and semitropical products such as cane sugar, bananas, coffee, tea, cocoa, and vegetable oils. In Canada these products and citrus fruit were the principal food imports. In both countries shipping shortages have substantially cut these imports, which have only partly been made good by home production. In the United Kingdom the nutritional function of imports has been to supply requirements that cannot be produced at home. By such means as raising the wheat extraction rate and switching from carcass meat to boneless and canned meat, from shell eggs to dried eggs, or from condensed milk to dried milk, and by eliminating most fresh and all canned fruit and other similar economies, the average caloric value per ton of aggregate imports of foodstuffs has been increased by 25 percent over prewar values, without counting the saving due to the elimination of imported feedingstuffs.

CONTROL OF FOOD USE

112. To implement wartime food aims it is necessary to allocate foods, especially those in short supply, between competing demands. In the United States "set aside" orders, which require handlers or processors to reserve stated percentages of their output for government purchase or "limitation" orders which restrict sales or certain uses of particular foods, now cover most commodities in short supply. This means of securing better utilization of available foods, labor, transport, and packaging resources is also applied to nonfood uses, for example, fats and oils for paint and soap, and grain for industrial and beverage alcohol. Canadian control follows broadly similar lines. The great development of bulk purchasing of imported foods into Canada during the war should also be mentioned; this now extends to sugar, tea, coffee, cocoa,

oils and fats, dried fruits, peanuts, grape-fruit juice, and a number of minor items.

113. The tighter food situation in the United Kingdom necessitates stricter control of utilization. On farms the feeding to livestock of millable wheat and of marketable potatoes is prohibited—on the whole successfully—while feedingstuffs such as wheat offals and oilcake are allocated to essential livestock. At the primary processing stage, distribution between nonfood technical uses—such as oils for soap and other industrial purposes—and food uses is also closely controlled. The allocation of such ingredients as fats, sugar, milk products, dried fruit, starch, and meat to makers of compound foods like cakes, jam, chocolate, meat pies, biscuits, and cereal breakfast foods is integrated with the over-all food manufacturing program. The latter is based on the prospective supplies of ingredients in short supply, on labor, packaging, and transport requirements, and on the nutritional value, palatability, and price of the product. The simplification of many products has saved labor and packaging and discouraged unnecessary consumption. When foods are ready for consumption they are allocated between the military services and domestic and catering establishments. Finally, in the case of such foods as milk or eggs, it is decided how far the needs of the priority classes should have precedence over those of the ordinary consumer.

WARTIME DEVELOPMENTS IN SCIENCE AND TECHNOLOGY

114. Similar trends in science and technology have been evident in the three countries. In all three there has been increased recognition of the important contribution that science can make to food management. This has been stimulated by shortages of food, labor, processing facilities, or ancillary materials, coupled with the need to maintain health and vitality and to develop new types of foodstuffs adapted to the special requirements of the armed forces, or to compensate for the restrictions in transport imposed on all foodstuffs by the war. The reaction to actual or threatened food shortages has been to bring scientific knowledge of nutrition to bear upon the problems of defining the peoples' food requirements and achieving such distribution of the available supplies as will meet these requirements to the fullest possible extent. Similarly, scientific knowledge and inventiveness have been drawn upon freely to increase food production, to evolve new forms of foodstuffs to meet wartime conditions, and to utilize alternate materials both as ingredients of manufactured foods and for the packaging of foodstuffs. Thus, the potentialities of scientific knowledge and research in food and nutrition have become more widely recognized in all three countries as a result of the war, and there has been a reorientation of scientific thinking to accord with practical wartime objectives. There follow some examples which illustrate these general trends.

UNITED STATES

115. In the United States the following measures have been undertaken during the war years :

(1) The Food and Nutrition Board of the National Research Council in May, 1941, prepared a table of recommended dietary allowances, which has been taken into consideration in the United States in fixing production goals and assessing food consumption.

(2) The nutritive content of common foods has been improved by the addition of minerals or vitamins. Such measures, some of which were in use before the war, include the addition of iodine to salt ; of Vitamin D to milk, particularly for relief purposes and child feeding ; of vitamin A to margarine ; and the enrichment of white bread and flour with iron, thiamine, riboflavin, and niacin. Compulsory enrichment of commercially made white bread with these nutrients is an important wartime development.

(3) In response to the need for supplying foods to the armed forces and Allies overseas in light, compact, and nonperishable form, the production of dehydrated foods has been expanded tremendously during the war. Whole milk, skim milk, eggs, and vegetables are now dehydrated on a large scale. The methods of dehydrating food have been improved considerably by scientific research and have resulted in marked improvement in palatability and nutritive value.

(4) A considerable part of the meat for the armed forces is shipped in the form of boned-out carcasses or selected cuts in the frozen form ; this has made possible a great economy in refrigerated shipping and warehousing facilities.

(5) Methods have been developed for the production of soya flour and other soya products, which are rich in protein, minerals, and B vitamins and at the same time inexpensive.

(6) Improved methods have been developed for the production of concentrated fruit juices, particularly citrus juices.

(7) There has been an expansion in the production of meat-flavor substances that increase the palatability of food materials, particularly soybeans.

(8) There have been tremendous increases to meet domestic, military, and lend-lease demands in the production of synthetic vitamins and vitamin concentrates. The increased production, coupled with greater manufacturing efficiency, has resulted in a great reduction in cost.

UNITED KINGDOM

116. Steps in the United Kingdom include the following :

(1) To spare shipping space and at the same time to improve nutrition, the extraction rate of flour was increased from the pre-war figure of about 70 percent to 85 percent in 1942, and, at one period of the war, wheat flour was diluted with small quantities of rye and oats. Attention was given not only to the production of a bread of enhanced nutritive value, but also to minimizing adverse effects upon the acceptability of the bread and hence upon its consumption.

(2) In the field of fortification, the main developments were the compulsory addition of vitamins A and D to margarine, most of which was fortified before the war, and the addition of calcium to bread.

(3) Numerous technical problems have had to be solved to reduce to the minimum the quantities of meat, sugar, syrups, fats, and fruit products in such commodities as sausages, meat pies, confectionery, breakfast cereals, fruit products, and jam, without so reducing their acceptability as to bring about a serious fall in the intake of calories. It has been necessary to "stretch" foods in short supply. Shortages in packaging materials have directed attention to essential functions so that packages should be developed in the simplest possible forms to meet these requirements.

(4) In the field of dehydrated foodstuffs, the only commercial development in the United Kingdom has been the establishment of a vegetable dehydration industry, but much fruitful research was undertaken from 1938 onwards on the dehydration of meat, eggs, fish and milk, as well as vegetables; the results have been of great practical value in the establishment of dehydration industries overseas.

(5) Studies on the storage properties of dehydrated foodstuffs have led to the recognition of various basic causes of deterioration. It is essential that the atmosphere in which certain commodities are contained shall be virtually devoid of oxygen. This has focused attention upon gas packing in which the air in the gas-tight container is replaced by an inert gas. Research has led to improved gas packing, based upon advances in manufacturing tin cans and sealing compounds, and in gas filling and testing the filled containers.

(6) A great saving in refrigerated shipping and warehouse space has resulted from the deboning of meat; quarters of beef, after deboning, are molded into slabs and transported in the frozen state.

CANADA

117. In Canada the war has stimulated the following measures:

(1) To improve the nutritive value of bread, "Vitamin B White Flour (Canada Approved)" has been encouraged since 1941. This consists of a flour of about 76 percent extraction, of which the minimum thiamine content is specified at 400 International Units per pound of flour.

(2) Industries for the dehydration of vegetables, eggs, and milk have been developed or expanded, and improved methods based upon research have made possible progressive improvements in quality. In vegetable dehydration, an improved form of dehydrator known as the Eidt tunnel is an important technical advance and has found widespread use in Canada and elsewhere.

(3) An attractive source of Vitamin C has been developed by fortification of apple juice with ascorbic acid. Production was at first reserved for the armed forces but was later made available to civilians.

(4) There have also been advances in methods of cutting beef, in fish drying, in the production of dried yeast for bakers' use, and in knowledge of mold inhibitors to improve the keeping quality of many foods.

(2) The nutritive content of common foods has been improved by the addition of minerals or vitamins. Such measures, some of which were in use before the war, include the addition of iodine to salt ; of Vitamin D to milk, particularly for relief purposes and child feeding ; of vitamin A to margarine ; and the enrichment of white bread and flour with iron, thiamine, riboflavin, and niacin. Compulsory enrichment of commercially made white bread with these nutrients is an important wartime development.

(3) In response to the need for supplying foods to the armed forces and Allies overseas in light, compact, and nonperishable form, the production of dehydrated foods has been expanded tremendously during the war. Whole milk, skim milk, eggs, and vegetables are now dehydrated on a large scale. The methods of dehydrating food have been improved considerably by scientific research and have resulted in marked improvement in palatability and nutritive value.

(4) A considerable part of the meat for the armed forces is shipped in the form of boned-out carcasses or selected cuts in the frozen form ; this has made possible a great economy in refrigerated shipping and warehousing facilities.

(5) Methods have been developed for the production of soya flour and other soya products, which are rich in protein, minerals, and B vitamins and at the same time inexpensive.

(6) Improved methods have been developed for the production of concentrated fruit juices, particularly citrus juices.

(7) There has been an expansion in the production of meat-flavor substances that increase the palatability of food materials, particularly soybeans.

(8) There have been tremendous increases to meet domestic, military, and lend-lease demands in the production of synthetic vitamins and vitamin concentrates. The increased production, coupled with greater manufacturing efficiency, has resulted in a great reduction in cost.

UNITED KINGDOM

116. Steps in the United Kingdom include the following :

(1) To spare shipping space and at the same time to improve nutrition, the extraction rate of flour was increased from the pre-war figure of about 70 percent to 85 percent in 1942, and, at one period of the war, wheat flour was diluted with small quantities of rye and oats. Attention was given not only to the production of a bread of enhanced nutritive value, but also to minimizing adverse effects upon the acceptability of the bread and hence upon its consumption.

(2) In the field of fortification, the main developments were the compulsory addition of vitamins A and D to margarine, most of which was fortified before the war, and the addition of calcium to bread.

(3) Numerous technical problems have had to be solved to reduce to the minimum the quantities of meat, sugar, syrups, fats, and fruit products in such commodities as sausages, meat pies, confectionery, breakfast cereals, fruit products, and jam, without so reducing their acceptability as to bring about a serious fall in the intake of calories. It has been necessary to "stretch" foods in short supply. Shortages in packaging materials have directed attention to essential functions so that packages should be developed in the simplest possible forms to meet these requirements.

(4) In the field of dehydrated foodstuffs, the only commercial development in the United Kingdom has been the establishment of a vegetable dehydration industry, but much fruitful research was undertaken from 1938 onwards on the dehydration of meat, eggs, fish and milk, as well as vegetables; the results have been of great practical value in the establishment of dehydration industries overseas.

(5) Studies on the storage properties of dehydrated foodstuffs have led to the recognition of various basic causes of deterioration. It is essential that the atmosphere in which certain commodities are contained shall be virtually devoid of oxygen. This has focused attention upon gas packing in which the air in the gas-tight container is replaced by an inert gas. Research has led to improved gas packing, based upon advances in manufacturing tin cans and sealing compounds, and in gas filling and testing the filled containers.

(6) A great saving in refrigerated shipping and warehouse space has resulted from the deboning of meat; quarters of beef, after deboning, are molded into slabs and transported in the frozen state.

CANADA

117. In Canada the war has stimulated the following measures:

(1) To improve the nutritive value of bread, "Vitamin B White Flour (Canada Approved)" has been encouraged since 1941. This consists of a flour of about 76 percent extraction, of which the minimum thiamine content is specified at 400 International Units per pound of flour.

(2) Industries for the dehydration of vegetables, eggs, and milk have been developed or expanded, and improved methods based upon research have made possible progressive improvements in quality. In vegetable dehydration, an improved form of dehydrator known as the Eidt tunnel is an important technical advance and has found widespread use in Canada and elsewhere.

(3) An attractive source of Vitamin C has been developed by fortification of apple juice with ascorbic acid. Production was at first reserved for the armed forces but was later made available to civilians.

(4) There have also been advances in methods of cutting beef, in fish drying, in the production of dried yeast for bakers' use, and in knowledge of mold inhibitors to improve the keeping quality of many foods.

COMMON DEVELOPMENTS

118. An important scientific development common to all three countries has been the systematic study of the composition of foodstuffs, including changes in nutritive value during storage, processing, and cooking. The results of these studies constitute an important advance in our knowledge.

119. The main lesson emerging from this aspect of wartime experience is the enormous value to communities, and to the community of nations, that results when governments encourage the fullest possible application of scientific knowledge of food and nutrition to practical problems of food management.

MARKETING ECONOMIES

120. The need to save manpower, transport, fuel, rubber, packaging and other ancillary materials and to release factory and storage space for war purposes has led, in all three countries, to economies in marketing and distribution, some of which may continue after the war.

121. In the United Kingdom the need for economy of nonfood resources has led to the temporary closing of excessive "marketing" capacity and the simplification of products and packages. It has also led to severe limitation of the districts in which firms may sell or deliver goods and of the markets at which farmers may sell their products. The marketing of milk is directly controlled as to route, allocation, and processing. To save transport and manpower, not more than one independent retailer and one cooperative society may deliver in any one street or group of streets.

122. Similar but less drastic economies have been made in the United States and Canada. In the United States government orders have required every-other-day delivery of milk and have halted return of day-old baked goods by the retailer. Packaging has become more functional and less decorative. Shortages of materials have occasioned some shift also in type of container, as from tin to glass. Consumer services such as store delivery have been greatly reduced. Food transportation by rail has been made more efficient by increasing minimum loads, reducing diversion and storage on tracks, and to some extent by shipping priorities.

123. In Canada restrictions have been placed on the frequency of wholesale and retail deliveries and on the use of private commercial vehicles; these have resulted in zoning and pooling arrangements and some general economies in the wholesale field. Zoning and pooling arrangements are compulsory in the farm collection of milk and cream. In the movement of goods from inland points to seaboard a permit system is in effect to secure prompt loadings, quick turnaround, and minimum congestion at terminals. Simplified packaging and reduction in the number of varieties and styles have been promoted.

124. In each of these countries economies in the assembly of agricultural products, such as the reduction of cross-haul transport and simpler packaging, may persist after the war; in other cases, particularly those that represent a wartime sacrifice by consumers, there may be a reversion to prewar practices. A study of these economies and their results would be highly desirable.

ECONOMIC DEVELOPMENTS AND PRICE PROGRAMS

125. In wartime, unless preventive measures are taken, the reduced supply of civilian goods, combined with increased civilian purchasing power, results in the price of goods soaring beyond the reach of the poorer sections of the community and gives rise to inflation of prices and wages. These dangers have been met in all three countries by price control, by rationing of commodities in short supply, and by taxation of surplus purchasing power, supplemented in the United Kingdom by diet shifts to foods that are cheaper in price and more economical in food resources. Thus, in the United Kingdom today more bread is eaten and less meat and more margarine and less butter than before the war.

126. In each country wages have risen substantially more than the cost-of-living index and, although taxation has risen sharply, wage earners are appreciably better off than before the war, while unemployment has virtually disappeared. In the United States average pay per nonagricultural worker in 1943 was 43 percent higher than in 1939, whereas the cost-of-living index had only risen by 24 percent but the index of retail food costs had gone up 44 percent. In the United Kingdom, by January 1944, earnings had increased by about 79 percent, whereas the cost of a prewar diet, if it could be purchased, had only increased by about 30 percent. In Canada average earnings have increased by about 45 percent since 1939 and food prices have risen by about a third.¹ At the same time taxation has tended in each country to level down the purchasing power of the higher income brackets and hence people's ability to buy preferred foods. The fact that payrolls have, on the whole, increased more than food prices and more than the general cost of living has certainly benefited nutrition, while reduced expenditures on other consumer goods has also had a favorable influence on food consumption. The key to this nutritionally important stabilization policy has been price control and government subsidies or trading designed to reconcile two conflicting objectives: the need to assure to farmers the returns necessary to obtain the desired production and at the same time to hold down retail prices.

127. Ceiling or maximum prices have now been established for practically all foods and for restaurant meals in the United States, United Kingdom, and Canada. When the difference between the ceiling retail or wholesale price and the support or fixed price paid to the farmer or for imports is smaller than the margin needed for processing and equitable geographical and social distribution, each government has, in the case of major foods, made good the loss by commodity, storage, or freight subsidies, or by meeting trading losses on government-owned food out of public funds.

128. In the United Kingdom food prices (measured in terms of prewar dietaries) have been stabilized at about one-third above prewar levels. In the United States the 1944 level was 44 percent above the 1939 level, although only about 37 percent above the 1935-1939 period. In Canada the increase has been somewhat smaller. But in the United Kingdom, for instance, this is costing the Treasury 200

¹These figures are not necessarily computed on the same basis for each country.

million pounds sterling per annum, or 21 to 24 pence per head per week, which is equivalent to about one sixth of average working-class food expenditure.¹

129. Thus, price stabilization and food subsidies, which have been the economic foundation of the agricultural and nutritional programs of each country, have been achieved largely at the taxpayer's immediate or ultimate expense. The citizen as a taxpayer has played a vital role in the success attained by these food management programs, but at the same time he has benefited as a consumer.

RATIONING AND CONSUMPTION PROGRAMS—GENERAL CHARACTERISTICS: "STRAIGHT" AND "POINTS"

RATIONING SCHEMES

130. Broadly speaking, the consumption programs of the United States and Canada have been designed to maintain average prewar levels of food consumption—in spite of increased consumer purchasing power—in order that the increased production might be available for military and Allied needs. Consumers have not, therefore, been able to obtain as much of some foods as they might have been willing to purchase. The chief instruments of this program have been control of food use, price control and its related subsidies, and rationing. In North America rationing has been used to control consumption and to secure more equitable distribution of favored foods in relatively short supply by ensuring that every civilian gets no more than his fair share.

131. In the United Kingdom the shipping shortage has necessitated drastic reductions in the consumption of many favored foods (see Table 1). The object of rationing has been to secure as good nutrition as possible from minimum use of food resources, to ensure "fair shares" and distribution in accordance with need for decreased supplies of animal foods, fats, fruits, and sugar in particular, and at the same time to stimulate consumption of less favored foods—breads, vegetables, and less well-known foods, such as dried eggs, which make better use of the national food resources or which are in ample supply and can replace in part the reduced supplies of meat.

132. The impact of rationing upon a people and its dietary cannot be judged solely by considering the number of rationed foods and the size of allotment to the individual. Due weight must be given to the objectives of rationing and the extent to which, by cutting across established food habits, it is likely to have adverse social and dietary repercussions. We do not, therefore, discuss in any detail what to the man in the street often appears to be the primary feature of wartime food management, viz., rationing, partly because the direct comparison of rations of particular foods is of limited validity, partly because rationed foods cannot be considered apart from unrationed foods and the whole dietary picture, but mainly because we do not believe that rationing is likely to be a feature of the peacetime food economy.

¹The cost of subsidies stated above is an estimate based on provisional trading figures which are so compiled as to show neither profit nor loss on (a) sale of goods received under lend-lease, and (b) goods delivered on reciprocal-aid terms to the United States or United States forces in the United Kingdom.

133. In the United Kingdom there are "straight" rationing schemes for carcass meat, visible fats, bacon, tea, cheese, sugar, and preserves. The consumer is entitled each week to a specified and fairly constant quantity of each food. "Points" rationing covers a wide range of "variety" foods in short supply for which the demand varies from household to household, and includes canned meat, canned fish, canned milk and canned fruit, biscuits, dried fruits, pulses, syrup and treacle porridge, rolled oats and breakfast cereals, and rice. Chocolate and sugar confectioneries are similarly rationed. Foods in short or uncertain supply, e.g., liquid milk, fresh eggs, dried skim milk, dried eggs, oranges—the perishable nature or unfamiliarity of which makes them unsuitable for straight or points rationing—are subject to controlled distribution which permits priority allowances to vulnerable groups, while allowing quick, seasonal, and, in some cases, local variations in the ordinary consumer's entitlement. Foods that are rationed or otherwise controlled in distribution provide about one third of the calorie supply. Highly perishable commodities in variable supply, such as fish and green vegetables, are unrationed, but equitable geographical distribution of them is attempted.

134. The fact that cheap but nutritionally valuable foods—bread, flour, and potatoes—have not been rationed and that factory canteen facilities have been increased enables the individual to make up his energy requirements without a complicated system of differential rationing or permits. These foods, which supply on the average 42 percent of the calories, are supplemented by unrationed food eaten in restaurants and canteens (10 percent of calories), and by unrationable perishables like fish and vegetables and a small range of unrationed manufactured foods (14 percent of calories).

135. In the United States sugar is on a straight ration, while there are two main categories of group or point ration foods, the first covering meats, fats, canned fish, most cheeses, and evaporated milk, and the second canned or otherwise processed fruits and vegetables. Poultry, milk, eggs, fresh fruit and vegetables, and grain products have not been rationed, although from time to time some special control of the distribution of these products, which have in general been relatively abundant, has been necessary.

136. In Canada foods on a uniform straight ration basis are sugar and butter; meat was also rationed on this basis, but greatly increased supplies brought temporary suspension of rationing in March 1944. Tea and coffee were rationed together, giving the consumer a choice, but rationing has now been lifted. Canned fruits, jams, jellies, marmalade, molasses, honey, maple syrup and sugar, corn, cane and blended table syrups, etc., are rationed as a group with sugar allowed as an alternate. All other foods are unrationed.

SPECIAL DISTRIBUTION SCHEMES

137. In each of these countries the practice has been to treat all consumers as equal but to make special allowances to important population groups. In the United States and Canada additional ration points or meats and fats are available for workers in certain very heavy industries, such as lumbering. In the United Kingdom additional allocations are given to the canteens of factories engaged in very heavy work, while "outside" heavy workers, such as farm workers

or quarry men, are entitled to additional allotments of cheese. In each country provision is made for special diets for medical purposes. In the United Kingdom special provision is also made for pregnant and nursing women and young children.

138. The effects of underfeeding caused by poverty tend to be most severe among those with the highest physiological needs for protective foods, that is, infants, children, and the mothers who bear them. The need to maintain civilian and military morale and to secure a numerous and vigorous successor to the present war-torn generation has made special schemes for these groups one of the key features of Britain's wartime consumption policy. In the United Kingdom under the national milk scheme, which has a take-up¹ of nearly 100 percent, expectant and nursing mothers, and infants and preschool children (0 to 5 years) can obtain one imperial pint of milk per day at just under half price or, if in the lowest income groups, free. The vitamin scheme permits the same classes to purchase cod-liver oil (take-up 22 percent.), or vitamins A and D (expectant mothers only—take-up 38 percent) and also fruit juices rich in ascorbic acid (take-up 53 percent) on a similar financial basis. Expectant and nursing mothers also have priority to purchase fresh eggs, dried eggs, and oranges. British school children (6 to 14 or more years) are entitled to one third imperial pint of cheap or free milk every school day in addition to their home allowance. The aim is to raise this amount (which in necessitous cases may now be made up to one imperial pint) to two thirds of an imperial pint at all schools. Three quarters of the school children of England and Wales now take school milk. The development of school meals is handicapped by wartime lack of kitchen equipment, etc. At present about one third of English school children and about one quarter of those in Scotland take cheap or, in necessitous cases, free school meals every day. The ultimate aim of this scheme, which, like all these special schemes, is mainly financed by the central government, is to ensure that every child has at least one good, well-prepared meal every school day. To this end the balance and nutrient content of school meals are closely watched. Possible failure to meet the high nutritional needs of post-school adolescents has caused anxiety in Britain. Cheap national milk cocoa (cocoa and skimmed milk) has therefore been made available for them at factories, offices, and colleges.

139. In the United States several programs were undertaken in the 1930's to make surplus foods readily available to underfed groups. These included school lunches, food stamps, direct distribution of food to needy families, and milk stations. The disappearance of major food surpluses and the increase in employment and wages in the early 1940's caused the suspension of these programs, except for that of school lunches which has been continued and somewhat expanded. The federal government paying approximately half the cost. Consideration is being given to the need to revive programs of this kind both as a means of improving the diets of low-income families and to maintain a steady demand for farm products. The possibility of a national school-lunch program is also being considered in Canada.

140. These special schemes for vulnerable groups offer one of the most potent means of improving nutrition at relatively small cost. They are

¹Percentage of persons entitled to a benefit who exercise their privilege.

one of the war developments that we feel could be greatly expanded and extended with advantage to all countries.

INDUSTRIAL-PLANT OR CANTEEN FEEDING

141. Feeding the worker on the job is another sound nutritional practice which has developed rapidly during the war in each of these countries and which, we hope, will be maintained and expanded in peacetime. The beneficial effects of plant feeding and its associated amenities on output, labor relations, health, the incidence of fatigue and accidents, and in providing a point on which nutritional education of the adult can be focused are increasingly recognized. In both the United States and the United Kingdom the governments have encouraged in-plant feeding by persuasion, allocation of priorities, and facilitation of food supplies. In the United States before the war, in-plant feeding services were available to probably less than 20 percent of all industrial workers. At the end of 1943 the total was 33 percent, an increase of at least seven million workers, and the present goal is 60 percent. In-plant feeding has also developed rapidly in Great Britain, and since 1940 the Ministry of Labour has had power to require all firms on war work employing more than 250 people to establish adequate canteens. Before the war the number of such canteens was less than 2,000; today it is over 16,000. For various social and economic reasons, however, the majority of British workers still take their midday meals at home or carry packed meals to work.

PROTECTION OF THE CONSUMER

142. Before the war the protection of the consumer against injurious food and misrepresentation in labeling and advertising had attained high levels in the United States and Canada. This legislation has been extended to include some mandatory standards of quality and description since deterioration in quality resulting from ceiling prices is as much a part of inflation as increasing prices for the same quality. As the United Kingdom Government has had to assume increased control over the purchase and distribution of food, the public has come to regard it as responsible not only for the supply but for the nutritive and cash value of their food. Further measures to protect the public against false and misleading claims on labels and advertisements have therefore been taken. At the same time, as the consumer is no longer free to choose his own milk retailer, the Minister of Food may, as the necessary processing plant becomes available, prescribe areas in which all milk must be pasteurized or otherwise conform to satisfactory bacteriological standards.

EDUCATION, PROPAGANDA, AND EXPLANATION

143. The support of the consumer and an understanding of the issues involved by those who help to form public opinion is an essential part of any democratic food program. In all three countries, therefore, public relations between the consumer and the government have become an important part of food management. But in addition to explaining to the consumer the why and wherefore of control, educational propaganda in Great Britain has been extremely useful in accelerating consumer acceptance of new products, in bringing about

more rapid changes in food habits, and in promoting efficient food management in the home.

144. In the United States education of the consumer has been through the press, radio, and bulletins, and considerable use has been made of school and adult education classes, the Agricultural Extension Service, and of recently organized state and local nutrition committees. Education has been designed to reduce waste, to stimulate garden production and home preservation, to induce the consumer to use foods that are in plentiful supply and those that may be new, such as soya products, as well as to secure a general increase in dietary knowledge.

145. In the United Kingdom comparable media and methods have been used. A feature has been the wide purchase of advertising space in the national and local newspapers for explanation and education, while the general policy has been to stress the importance of particular foods, such as milk, rather than attempt to inculcate dietetic principles.

146. An interesting point has emerged from the United Kingdom experience of rationing and special distribution schemes. While their obvious purpose is to make adequate quantities of suitable foods available to all according to their needs, there is a secondary effect which may be of considerable importance to future food management planning. The fact that under any particular scheme a consumer is entitled to a specific amount of a particular foodstuff, provides him with a strong incentive to obtain it, whether or not he would otherwise have wanted it. This urge to obtain one's right is deep-seated and has been exploited to good effect in fostering the consumption of beneficial foods. In Canada education of the consumer has been an integral part of the price control program.

STATISTICS FOR MEASUREMENT AND APPRAISAL OF RESULTS

147. National food management is impossible without proper data upon which to base it. Fortunately, although each of the three countries at the beginning of the war had little detailed information about average food consumption and the diets of special groups, the agricultural and trade statistics were reasonably adequate. Statistics are one of the by-products of government control and the range and accuracy of food statistics have accordingly increased in each country during the war. With the return of peace there may be some statistical retrogression; it is therefore worth recording that good national food management largely consists of political and administrative skill in applying scientific and statistical knowledge to the improvement of human nutrition and agriculture.

148. But national statistics of acreages, imports, stocks, prices, etc., do not tell the government what is happening to the individual. Hence, to check that programs are working according to plan and to obtain data on the incidence of malnutrition, government and private-sampling surveys of consumers have been used. In the United States a large-scale dietary survey was made in the spring of 1942 as part of a study of family spending and saving in wartime.

149. In the United Kingdom a continuous food survey which records details of all food purchases during one week is collected from 800

working-class households in twenty towns each month and the nutritive value per head is calculated. This survey yields invaluable data on food expenditure and habits, on the apparent adequacy of the diet, and on the administrative aspects of, for instance, the school-milk scheme. It cannot, however be used to measure the nutritional status of the individual. Hence, as a check of the over-all adequacy of the diet, the body weights of samples that include school children, industrial workers, and housewives are systematically collected. Unfavorable trends in body weight would indicate inadequate intake. Further, in selected British towns, sample households are chosen in which children have been born during the preceding two years. The weekly food purchases and the living conditions of each household are recorded, while its members are examined for early clinical signs of malnutrition and specimens of their blood are biochemically analyzed.

150. The technical advances in dietary and similar statistical studies that have been made during the war will no doubt prove valuable not only in these three countries but in other countries and particularly in regions where the national statistical machine is undeveloped. Sampling surveys of this type can, if well-designed, be used to collect information not merely about the incidence of particular nutrient deficiencies but about income, status, occupation, customs, habits, and other factors that affect dietary adequacy. This information is essential to the administrator both in itself and as a means for supplementing the national statistics collected by the census and other means.

5. RESULTS OF WARTIME FOOD MANAGEMENT IN CANADA, THE UNITED KINGDOM, AND THE UNITED STATES

AVERAGE POSITION IN 1943

151. What have been the results of the programs described in the previous section? To summarize the state of food supplies in the three countries during 1943 and their relation to nutritional and dietary standards, we cite the conclusions of a Special Joint Committee of the Combined Food Board on food consumption levels in the United States of America, Canada, and the United Kingdom.¹

(a) In the United States, Canada, and the United Kingdom the total food supplies currently entering into civilian consumption, if they were distributed broadly in accordance with physiological needs, would with one exception, be sufficient to meet nutritional intake requirements on a restricted² basis without impairing health, morale, or working efficiency. The exception is in respect of the Canadian supply of

¹ Combined Food Board, Special Joint Committee, *Food Consumption Levels in the United States, Canada and the United Kingdom*, Washington, April 1944, pp. 16-17. (International documents are published concurrently by a number of the participating governments. Specific citations are given here to the documents as published by U. S. Government.) Although figures in Tables 1 and 2 in the text and 7 to 12 in Appendix I represent some revisions of comparable tables in this reference, the interpretation in the above paragraphs still applies.

² Roughly 70 percent of the National Research Council allowances for minerals and vitamins for adult men and adult women other than expectant and nursing mothers.

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ascorbic acid which appears to be marginal. With the exceptions noted below, they would be adequate to meet intake requirements based on the full National Research Council (United States) "recommended dietary allowances" of nutrients. The exceptions are: certainly ascorbic acid in Canada; probably vitamin A in the United Kingdom (allowing for the considerable losses of the latter nutrient which may occur in storage, preparation, and cooking); and possibly riboflavin and thiamine in all three countries.¹

(b) The estimated *per caput* supplies of most nutrients in the United States and in Canada are greater than in the United Kingdom. The calculated average nutrient intake requirements of the three countries are practically the same. With the exception of a few individual nutrients, the margins between nutrient supplies and intake requirements actually existing at present in the United States and Canada are wider than in the United Kingdom. Some margin must be allowed because waste in consumption and disparities of distribution in relation to needs cannot be entirely eliminated. Under present conditions these are probably greater in the United States and Canada than in the United Kingdom.

(c) To the extent that the distribution of food in the three countries can be so improved as to narrow the range of variations in consumption that now exist above and below actual requirements, the total food supply necessary to ensure an adequate level of consumption for the population as a whole will be correspondingly reduced. In the United Kingdom essential foods, broadly speaking, are already being distributed according to needs and the scope for further modification of the distribution pattern along these lines is narrowly limited.

(d) From the point of view of variety, acceptability to the consumer, and culinary convenience, the United Kingdom diet is inferior to those of the United States and Canada. In the United States and Canada considerable economies in the use of basic food resources are physically possible. To achieve them would involve further adjustments in the commodity composition of the supplies entering into civilian consumption, i.e., through further shifts from commodities in the production of which resources yield relatively low nutritional returns to those where the nutritional returns are higher. The need for economy in shipping and in agricultural production has already resulted in substantial changes in the commodity composition of the United Kingdom diet. In the present circumstances further appreciable changes of an unfavorable character in the United Kingdom diet would give rise to apprehension about their possible effects on the work, output, health, and morale of the civilian population.

(e) In all three countries dietary changes must be considered in relation to public reactions. A material reduction in the acceptability of the diet may have serious consequences both on the morale and on the nutritional status of the population concerned. Any substantial

¹ Recent figures indicate that the above conclusions which apply chiefly to 1943 also hold for 1944 with the exception "that supplies of ascorbic acid in Canada have shown some improvement and now approximate requirements." (Food Consumption Levels....., Second Report, December 1944.)

change in the composition of civilian supplies from favored and familiar foods to less favored or to less familiar foods can be safely made only if it is possible to convince consumers that the circumstances fully justify the adjustments required of them, and if due account is taken of the fact that the process of consumption adjustment will require time and guidance.

152. But these figures and conclusions are based on averages. How has the individual fared? Is his nutritional status better or worse than before the war? These are difficult questions to answer.

OBSERVED RESULTS OF NUTRITIONAL POLICIES

153. In the United States further evidence of the relatively high dietary levels prevailing in the early 1940's comes from a study of family food consumption made in the spring of 1942. Results of this survey show considerable improvement since 1936. Families had more money to spend for food in 1942 and they bought more milk, eggs, vegetables, and fruit. The 1936 study indicated that half or more of the families in this country had diets that failed to meet the National Research Council's allowances for calcium, ascorbic acid, thiamine, and riboflavin. Estimates from the 1942 study suggest that more than half still did not meet the recommended allowances for riboflavin although levels were considerably higher. But the proportion of diets short in calcium had been reduced to less than a third, in thiamine to a fourth, and in ascorbic acid to less than a tenth. There was considerable reduction also in the proportion of diets that failed to provide the recommended allowances of other nutrients.

154. Nevertheless, recent studies of diets and nutritional status confirms the prevalence of nutritional deficiencies at least in mild form. Fortunately, however, florid nutritional deficiencies are becoming rare in the United States, and it is generally agreed by doctors in areas where pellagra has prevailed that this disease, at least in its acute form, is now seen less often than before the war.

155. The Canadian wartime dietary has improved in nutritional quality and suffered little from reduction in variety of foods except in the luxury class. The improvement in health during the decade before the war has continued through the war years.

156. The United Kingdom, however provides the most striking example of the benefits of national food management. In the United States and Canada wartime dietary improvement has been associated with greater consumption of more expensive foods; in the United Kingdom with a reduced consumption of expensive foods, i.e., meat, butter, poultry, eggs, and fruits. Improved nutrition has been obtained from better use of reduced total food resources. Hence British experience is important to all Western countries, for if malnutrition can be greatly reduced with less food resources, the potentialities for rapid improvement in Western dietaries from normal or increased food supplies must be very great.

157. The average national statistics given in Tables 1 and 2, considered in the light of the food distribution and nutrition policies brought into operation during the war, confirm the belief that in the United Kingdom a very large proportion of the people are better nourished than before the war. The regulation of the consumption of

milk so as to ensure that the needs of the vulnerable groups are given priority, and the up-take under the special schemes for these groups of vitamin supplements indicate that this most vital problem of nutrition, namely, the proper nourishment of the unborn child and of the infant, is being effectively attacked. It can be claimed to-day that it should be possible for nearly everyone in the United Kingdom to get a nutritious diet. It was not so before the war. Evidence from dietary and clinical surveys since the war points to a general improvement in the nutritive value of the diet of the people, more particularly those in the lower income classes.

158. It is unfortunate that there are so few prewar data that are strictly comparable with the results of surveys made during the course of the war. This makes it difficult to obtain a clear picture of the improvement in nutrition that is believed to have occurred. There is, however, some evidence that enables a comparison to be made.

159. There has been no adverse trend of body weights. There is even an indication that the rate of growth of school children, as well as their general health, has shown improvement, but further information is necessary before a definite conclusion can be reached.

160. The Ministry of Health's clinical surveys of samples of the population to detect obvious symptoms of nutritional disorders have provided encouraging evidence of improvement. Among the several thousand people examined, the proportion of all ages and both sexes classified as of good nutritional condition has risen steadily since the investigations were begun in the summer of 1942. The high percentage of adults and adolescents classified in the top nutritional grade in 1944 is noteworthy. It is reasonable to assume that the decreased incidence of recognizable disorders of nutrition reflects a similar reduction in the extent to which the population is affected by deficiency conditions not detectable by the tests employed.

161. A recent study of the hemoglobin level of several thousand people of different ages and occupations in the United Kingdom has shown that there has been, during the war, a substantial and nationwide reduction in the incidence of anemia, probably due in large measure to the increased iron content of wartime bread.

162. It is not known to what extent better nutrition has been responsible for the reduction of maternal and infant mortality revealed by the figures for 1940-1943, but it is thought that the special allowances of milk and vitamin supplements must have played an important part in bringing about this improvement. The maternal mortality has fallen steadily from 3.1 per thousand births in 1939 to 2.3 in 1943, while the infant mortality rate, after rising from 50 per thousand in 1939 to 59 in 1941 when food conditions were at their worst, fell back to 49 in 1943, and to a still lower level in 1944.

163. A survey of the incidence of rickets in wartime, covering over 5,000 infants, has led to the conclusion that in so far as there are prewar investigations at all comparable, it would appear that, taking a broad view, there is no evidence of any increase in the incidence of rickets. Doubtless the position has improved since this survey was made at the beginning of 1943, because there has since been a marked

increase in the distribution of vitamin D to expectant mothers and young infants and a rise in the calcium content of the general diet.

164. There are also indications that the incidence of badly formed teeth and dental caries was much less in 1943 than 1929. This is based on a study of London school children, and the improvement is believed, by the investigators concerned, to be largely due to the national food policy.

INFERENCES FROM SURVEYS

165. Subject to the qualification that the effects of wartime diet on the civilian population may not be fully apparent for some years, it may be concluded that the United Kingdom has apparently found it possible to maintain or improve nutritional status and general health with a diet which (at prewar prices) is about 20 percent. cheaper than the national average diet of 1938 and with total food resources much less than prewar. It must however be emphasized that not only is the margin of safety low but that much of this apparent success is attributable to factors that may not continue after the war. A series of bottlenecks for controlling supplies and a realization by the public of the need for control have both proved invaluable. Farmers, food traders, and the general public have accepted a degree of control which would not be tolerated except as a wartime necessity to a nation fighting for its life, while consumers have accepted diets which by prewar standards lack palatability and variety. Nevertheless, much of the technical and administrative experience and of the scientific and statistical knowledge won during the last five years should prove of permanent value. Fortunately, wartime developments that might be most profitable nutritionally for future generations have been the least dependent upon government control, expensive administrative machinery, or unwelcome changes in food habits. The schemes for extra and cheap protective foods for pregnant and nursing women, children, and adolescents; the provision of school meals and school milk for children and of plant feeding for industrial workers; and the enrichment of two staple foods of the lower income groups, viz., bread and margarine, fall in this class.

166. It is estimated that, if these benefits had been available and fully taken up before the war in the United Kingdom, the diets of that section of the population in which the incidence of malnutrition is highest would have approached estimated requirements in most nutrients at relatively small cost. It has been calculated that the diet of the poorest 10 percent of the population immediately prior to 1936 (as estimated in Sir John Orr's *Food, Health and Income*¹) would have been adequate in animal protein, iron, and thiamine, and that the intake of other essential nutrients would have been greatly improved if the current welfare and fortification schemes had been in operation and full advantage had been taken of them at the time of Orr's study (see Table 4). In the United Kingdom these schemes, if provided free of cost to beneficiaries and if fully used by those eligible, would cost about 26 pence per week per child under 5 years, and 12 pence per week per child of 5 to 14, or an average of just over 6 pence per head per week of the whole of the poorest section of the population. They could, with some adjustments, substantially abolish inadequate

¹ Orr, Sir John, *Food, Health and Income*, London, 1937.

diets as measured by the United States National Research Council's recommended dietary allowances. Although possibly less acceptable, they would almost certainly have a greater nutritional effect than would result from a children's allowance of 5 shillings per child per week.

167. Emphasis on the wartime achievements in the United Kingdom must not be interpreted as endorsing her present food economy as a model for peacetime use in Western countries. On the contrary, the Committee strongly believes that each country must work out its own food plans as the United Kingdom has done.

TABLE 4. ESTIMATED EFFECT OF SPECIAL WARTIME MEASURES ON NUTRITIVE VALUE OF PREWAR LOW-INCOME DIETS IN THE UNITED KINGDOM ^a

Item	Protein ^b (Percent)	Calcium (Percent)	Iron (Percent)	Vitamin A (Percent)	Thiamine (Percent)	Riboflavin (Percent)	Niacin (Percent)	Ascorbic acid (Percent)
A. 1936 diet average of poorest 10 per- centc ...	84	38	73	19	61	58	73	66
B. 1936 diet (A, above) as affected by wartime schemesd ...	101	75	105	49	111	81	92	80
C. 1936 diet (A, above) as affected by children's allowancee ...	101 (?)	48 (?)	83	26	...	...	...	80

^aNutrient consumption expressed as percentage of National Research Council's recommended allowances.

^bAnimal protein only and not therefore, fully comparable with National Research Council's figure.

^cOriginal estimate made by Sir John Orr in *Food, Health and Income*, 1937, of the average nutrient consumption of the poorest 10 percent of the United Kingdom population.

^dEstimated average nutrient intake of the same section of the United Kingdom population if existing (1944) welfare schemes—national milk and vitamin schemes, school milk and meal schemes—had been available and fully utilized in 1936, and with 1944 nutrient standards of fortified flour and margarine.

^eEstimated average nutrient intake of the same section of the United Kingdom population if a children's allowance of 5 shillings per child per week were in operation.

6. FOOD MANAGEMENT AFTER THE WAR

THE CENTRAL PROBLEM

168. The food supply and consumption of a family or nation in time of peace is a result of many biological, social, and economic influences. It has been shown that satisfactory diets can be secured from many combinations of cheap or expensive and dull or palatable foods. The various methods used in the United Kingdom, Canada, and the United States during the war, and discussed in the Report of Section I of the Hot Springs Conference,¹ are illustrative.

169. Some of these combinations, however, and the methods used for introducing them into popular use, though feasible in time of war, may be socially and economically unacceptable in peacetime. The end sought, in peace as in war, is a closer equation of physiological needs and productive resources, but needs and resources are only two of many factors that under peacetime economic and social systems determine the food supply and its dietary adequacy for a family or a nation.

170. Scientific research has made it possible to define, with sufficient precision to guide practical food management, the amounts of nutrients needed to enable people to reach the full measure of their inherited capacities. Yet many nations and many people in almost every nation are living far below this potential level. Their food supplies, while adequate for survival and reproduction, need improvement in order to support a long, healthy, and abundant life. Our primary problem, then, is to devise socially and economically acceptable measures for reducing or abolishing this gap.

ANALYSIS OF THE PROBLEM

171. As a standard toward which to work, the recommended dietary allowances of the Food and Nutrition Board of the United States National Research Council (Table 3) may well be used. These standards have been widely accepted although it is realized that in countries with limited food resources intermediate goals may first have to be set.

172. Physiological needs in terms of calories, proteins, minerals, and vitamins can be translated into many different food patterns. No one pattern will be preferred by, or found most suitable for, all countries. From country to country, and also from family to family in the same country, there will continue to be differences in the kinds and amounts of foods consumed in obtaining the needed nutrients. For example, Table 5 shows two nutritionally adequate food plans. One is substantially cheaper than the other, but both are suitable for dietaries of the pattern considered typical of the United States of America. The lower-cost plan includes larger quantities of grain products, dry beans and peas, and potatoes, which are economical to produce, market, and store; while the higher-cost plan includes larger amounts of fruits, fresh vegetables, meat, eggs, and milk. The latter foods are generally consumed in larger quantities by well-to-do families than by poor families or countries because they are relatively

¹ United Nations Conference on Food and Agriculture, *Final Act and Section Reports*, Washington, 1943 pp. 35-51.

expensive to buy or produce, market, and store. The higher cost dietary requires about 20 percent more land and costs about 40 percent more at retail prices than the lower cost.

173. If nutritional needs were the only consideration, even cheaper diets would be adequate. Such diets would contain larger quantities of grain products, dried beans and peas, oils and refined fats, starchy roots such as potatoes and yams, and only small quantities of the relatively expensive animal products, fruits, and vegetables. These diets, although nutritionally adequate and 50 percent cheaper than the lower cost diet shown in Table 5 may be so unpalatable for some people as not to be eaten. Palatability, even though it is in part determined by such social factors as food habits and lack of knowledge, must be given considerable weight in peacetime food policies.

TABLE 5.—TWO NUTRITIONALLY ADEQUATE FOOD PLANS: APPROXIMATE YEARLY QUANTITIES^a OF VARIOUS FOODS OR GROUPS OF FOODS NEEDED PER CAPUT FOR THE POPULATION OF THE UNITED STATES

Item	Unit	Lower cost diet	Higher cost diet
Flour, cereals	Pound	225	185
Milk, or its equivalent ^b	Quart	250	300
Potatoes, sweet potatoes	Pound	190	155
Dried beans, peas, nuts	"	32	12
Tomatoes, citrus fruits	"	80	100
Leafy, green, and yellow vegetables	"	130	160
Other vegetables, fruits	"	120	205
Fats (including butter, oils, bacon, salt pork)	"	49	57
Sugars, syrups, preserves	"	54	57
Meat, poultry, fish	"	85	130
Eggs	Dozen	17	25

SOURCE: United States. Department of Agriculture, Bureau of Human Nutrition and Home Economics.

^aThe figures given in this table are computed from diets adapted to the needs of individuals of different age, sex, and activity groups and from the number of persons in each group as estimated for 1942. The quantities are those which should be delivered to the family kitchen. To convert them into production figures, suitable margins must be added to the different food groups to cover the unavoidable losses in harvesting, grading, storage, manufacture, or distribution.

^bIncludes fluid milk and its equivalent in the forms of condensed, evaporated, and dried milk, cheese, cream, and ice cream. The equivalences are figured on the basis of the nonfat milk solids.

If this factor is ignored, people on the poverty line will often spend their money on what is to them palatable but what is, in fact, a less nutritious diet.

174. Farther down the poverty scale a point is reached at which, even with the best use of the household food budget or of locally available land and other farm and food resources, it is impossible to secure an adequate diet from the foods that people can grow or buy. This is the present position both among low-income groups in highly industrialized communities and in less developed rural areas, particularly where the population is dense. In the latter areas nutritional programs must be initially simple, and develop gradually.

175. It is therefore clear that there is no single answer to the nutrition

problem, even in Western countries. Continued progress in the offensive against malnutrition must come from the combined operations of administrators, scientists, farmers, and traders, backed by an educated and informed public opinion. The strategy of this offensive must be adapted to the physiological needs, the natural resources, the economic and social conditions of each country or cultural group, and present or potential opportunities for exchanging products with other countries. Governments will necessarily make their own programs for their own people, but it will be an important function of FAO to provide technical assistance to governments that request help in formulating these programs.

FORMULATION OF FOOD MANAGEMENT POLICIES

176. A prerequisite to giving such aid is a survey of the physiological needs, the food consumption habits, and the food supplies and resources of the nation as a whole and of the groups therein most likely to be undernourished. For this purpose statistics of the population (age, sex, etc.) and of the supply of each important food are necessary, together with data on the chemical composition and nutritional characteristics of such foods. This permits the average supplies and average requirements of nutrients to be compared, as in a survey recently completed for the United States, United Kingdom, and Canada.¹ A complete survey would have to include dietary and clinical studies of samples of the major regional, social, and income groups within the country. At the same time the agricultural pattern and the unused food resources of the country should be surveyed in detail. In countries where the statistics are not sufficiently developed, reliance may have to be placed solely on sample studies, but the object will remain the same, namely, to obtain an accurate picture of the nutritional status of the population.

177. With this information available, it would be possible for each country to formulate food management programs based on the results of these surveys and the methods most suitable for the country as a whole or for those groups whose diets are in greatest need of improvement.

178. The Committee recommends :

(1) That, as soon as practicable, FAO should undertake detailed studies of the technique of measuring and comparing the nutritional status of Western and less developed countries, and that, as statistics are absolutely essential to the proper utilization of food resources, FAO should be invited to pay particular attention to the type of statistical material required in developing programs for the practical and actual satisfaction of nutritional needs.

(2) That, in the light of these studies, FAO might invite every government, through its national nutritional organization jointly with other appropriate national authorities to survey its own resources in relation to its over-all needs and, on the basis of this

¹ Combined Food Board, Special Joint Committee, *op. cit.* While the statistical techniques used should prove useful, it must be emphasized that this report did not cover the incidence of malnutrition.

survey, to draw up an integrated nutrition, food, trade, and agricultural program. This should not only serve as a target for producers, consumers, scientists, and administrators but should assist other countries in framing their own programs. Reports on the progress of these programs might form a part of the annual reports which governments are expected to make. FAO could perform a useful function by making a study and report on the international implications of these programs, in accordance with Recommendation XV paragraph 4 (b) of the report of the Hot Springs Conference.¹

(3) That, for this purpose, FAO should prepare itself at an early stage to supply technical information and to give advice to governments on all these matters.

METHODS OF SUPPLEMENTING POLICY

179. Each country or group must choose its tools with care. Thus, in advanced industrial countries, which can expect a continuously improving standard of living, greater reliance can be placed on increasing purchasing power of the consumer than in less developed countries. In the latter, measures to distribute food to the vulnerable groups on the basis of need rather than income may prove more feasible in the immediate future. Hence, the methods to be used and the emphasis given to each will depend upon the resources and the social and economic circumstances of each country. Here it is possible only to outline potentialities.

180. In the present state of knowledge, the most important potential instruments for food management programs available in Western countries are :

(1) Production and trade policies that provide food adequate in kind and quantity for good nutrition.

(2) Improved marketing efficiency.

(3) Increasing national purchasing power and measures to diminish poverty among lower income groups.

(4) Education to encourage food habits consistent with nutritional knowledge and to make the best use of food resources.

(5) Improving social distribution of food supplies, with special reference to vulnerable groups.

(6) Improving and conserving the nutritive quality of foods.

(7) Protecting the consumer against unwholesome food and undesirable trade practices.

181. Rationing is excluded from this list, although as a wartime measure its value has been demonstrated. Rationing can be used to alter food habits in desirable directions and to distribute foods in limited supply more nearly in accordance with need. It may be questioned, however, whether rationing will continue after the period of war shortages is over.

¹ United Nations Conference on Food and Agriculture, *op. cit.*, p. 19.

SUPPLY PROGRAMS

182. Before the war the agricultural, import, export, and fiscal policies of most countries were not based on nutritional considerations. In fact, they were sometimes antinutritional in character. It would be more sound for most Western countries to base policies on the welfare of both producer and consumer. As the Hot Springs Conference pointed out, such policies are in general consistent not only with increased international trade but also with better farming.

183. Over the next year or so most governments will be framing their agricultural, external trade, and fiscal policies for the reconstruction period. Many of them will be particularly concerned to secure increased supplies of dairy products, fruits, vegetables, and protective foods generally. In less developed areas, where these relatively expensive foods cannot be consumed extensively, other and cheaper foods may have to be used, but these diets need not be nutritionally inferior since adequate diets can be made up from many combinations of foods.

184. As an essential preliminary step in the formulation of nutrition programs, governments will need to make an appraisal of the relative efficiency of various imported or home-produced foods in supplying nutrients in terms of price, land, labor, and other resources.¹ In many parts of the world little is known of the relative nutritive efficiency of locally available foods. However, data of this type have played an important part in building up the wartime agricultural and import and export programs of the United Kingdom, United States, and Canada.

185. The Committee recommends, therefore, that FAO should encourage governments to develop the technique of measuring the relative efficiency of both domestic and imported foods in supplying nutrients in terms of land, labor, monetary and other resources, and should, on request assist governments in this work.

186. Such direct food crops as wheat, rice, maize, dried beans, oilseeds, potatoes, and some root vegetables give good yields of nutrients per unit of land, labor, and other farm resources. They can be stored and transported cheaply and easily; and they are suitable for peasant culture or large-scale mechanized agriculture. Nutritionally they are important as sources not only of calories but of protein. While the proteins of white flour, white rice, and degerminated maize products need supplementation, those of whole-grain products are of high nutritive value; those of the oilseeds and many pulses are also valuable in themselves and as supplements to the proteins of white bread and other refined grain products. These facts have not yet been fully exploited in the interests of human welfare. Grains, whole or lightly milled or properly enriched, also make a valuable contribution to some of the mineral and vitamin needs of the diet. This is particularly true of thiamine. Potatoes, if properly cooked so as to retain much of their vitamin C, can make important contributions

¹ It must not be forgotten that, in this sense, expenditure of resources does not end until food has been delivered to the consumer. For example, it covers manufacture of sugar, milling of flour, transport, and wholesale and retail services.

of this vitamin as well as of several other nutrients in lesser amounts. Dry beans and peas are good sources of iron and the B vitamins.

187. Green and yellow vegetables are particularly important sources of vitamin A, and some are good sources of vitamin C. Tomatoes, too, are good sources of vitamins A and C while citrus fruits are especially rich in vitamin C. Fresh garden vegetables and fruits are so rich in nutritionally important mineral elements and vitamins that the fresh products of a relatively small area devoted to them goes a long way to balance a diet deriving most of its calories from the cheaper sources. War experience in the United Kingdom has shown that garden plots can make important contributions to the mineral and vitamin values of the family food supply, especially when devoted largely to the growing of fresh, green and yellow vegetables and tomatoes. The use of even small amounts of land in both urban and rural communities for the growing of fresh vegetables and fruits should be an important feature of improving local nutrition.

188. The Committee, therefore, endorses the recommendation of the Technical Committee on Agricultural Production that FAO give early attention to the problems involved in increasing the production of vegetables and fruits, especially in the less developed countries, and in maintaining the wartime increases in vegetable production and consumption.

189. Foods of animal origin are important sources of high-quality proteins, certain minerals, and essential vitamins. When the animals are fed largely with cultivated crops such foods tend to be more costly than foods grown for direct human consumption; for no animal can pass on as human food the whole of the nutritive value of what it has eaten. It is important to recognize certain inherent differences among livestock that influence the desirable proportions of each type for any given country or region to maintain. Some animals live mainly on grazing and forage which would in no case be used as human food, while others subsist more largely on grain, competing for the food supply not only with other classes of livestock but with human beings as well. Thus, beef cattle or sheep, making meat from the forage of range pastures, may represent the best possible use of this source. However, in times of stringency it is a point of prime consideration that highly grain-fed bees consume food resources that would be better used directly as human food. The dairy cow, like sheep and cattle, subsists to a considerable extent on natural grazing and forage or on pastures and fodder that are a by-product of a mixed-farming system, supplemented in most Western countries by grain and other concentrated feedstuffs. As was pointed out at the Hot Springs Conference, "It is fortunate, in view of the high nutritive value of milk, that milch animals can be recommended not only as animals valuable in farm economy but also on the grounds of their relatively high efficiency as converters of feedstuffs into human foods."

190. Refined sugars and fats (other than butter and fortified margarine), although they are high-calorie foods and are cheap to produce in many countries, contribute little or no minerals and vitamins to the diet. For this reason, only limited quantities are usually recommended in nutritionally adequate diets.

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PRICES, SUBSIDIES, AND FINANCE

191. During the war, price incentives and propaganda—supplemented in the United Kingdom by some compulsion—have been used in the United States, the United Kingdom, and Canada to help secure the production of the quantity and kinds of food most important to the war effort of the United Nations. However, the pattern of production developed to meet a war situation may not necessarily coincide with the needs of a peacetime economy.

192. War experience has shown that it is possible to alter the pattern of a national diet fairly rapidly by changing the make-up or balance of the national food supplies. In part, however, such wartime changes have been enforced by rationing, price control, and the absence of other foods. For instance, it is doubtful if cheese consumption would have increased to the extent it did in the United Kingdom had more meat been available, even if the price of cheese had been substantially reduced.

193. After the war many countries may continue for some time to control maximum food prices in order to hold down the cost of living and prevent inflation. Others may emphasize support of farm prices. The United States, the United Kingdom, and Canada have each announced programs to control the prices of some agricultural commodities for varying periods after hostilities have ceased. This subject is discussed more fully in the report of the Technical Committee on Agricultural Production. It is hoped, however, that any forms of price support necessary to prevent a serious drop in farm incomes will be used with discrimination and with the aid of scientific counsel in order to assure the availability of—and proper balance among—the various groups of foods essential for nutrition.

194. The use of the price mechanism to assist farmers and to adjust the production pattern of one country cannot be divorced from the import and export of foodstuffs and feeds or from the wider problems of international trade. Wartime experience in this field has been determined largely by shipping and strategic factors and by the efforts of exporting countries to aid their Allies. Strictly economic considerations have had to assume a minor role. After the war, however, if the world is to achieve the expanding economy recommended at the Hot Springs Conference, steps will have to be taken to encourage international trade in food and feedingstuffs. Indeed, we cannot expect rapid progress in world nutrition unless this is done.

195. The Technical Committee on Agricultural Production has drawn attention to the interest that FAO will have in commercial policy, while *The Work of FAO* points out the need for an international trade organization with responsibility for promoting the interchange of goods. The Technical Committee on Nutrition and Food Management holds a similar view and therefore recommends that FAO in collaboration with appropriate international commercial and financial organizations, study methods of increasing international trade in food and feedingstuffs.

196. Shifts in the patterns of agricultural production and international trade may contribute greatly to the improvement of nutrition, especially in underdeveloped countries. As was pointed out in the

discussion of reorientation of agriculture in the Report of the Technical Committee on Agricultural Production, such shifts involve many complicated factors and will be an important area of study for FAO. The Technical Committee on Nutrition and Food Management stresses here the need for giving full attention to food requirements for good nutrition in working out such programs of agricultural reorientation.

EFFICIENT MARKETING

197. The cost of marketing is extremely important to both consumer and farmer, since it greatly affects the level of consumption of many goods. For this reason, the Hot Springs Conference recommended that FAO should give special attention to the possibility of assisting in the development of efficient methods of assembling, transporting, storing, and distributing foods. Marketing is a wide and complex technical problem to which FAO will no doubt devote considerable attention. The potentialities of improved marketing were emphasized at the Hot Springs Conference. Here, therefore, the Committee does no more than draw attention to one or two marketing factors of particular nutritional significance.

198. Some of the processing techniques and methods of transporting, storing, and distributing foodstuffs developed during wartime could, if widely adopted where economically feasible, effect a veritable revolution in making available more and better foods to consumers and wider markets to producers. Throughout many parts of the world marketing is still conducted in a rudimentary way. The newer techniques will in many cases make possible immediate use of advanced methods of distribution, avoiding all of the laborious stages of marketing development through which other sectors of the world population have had to progress.

199. This may be illustrated by the problem of providing milk to the populations of areas not well suited to dairying. It will no longer be necessary for each such section to establish at great expense and against adverse natural conditions, facilities for the production, assembly processing, and distribution of fresh milk. Dehydrated, evaporated, or condensed milk produced in distant parts of the world could be used to supply this essential food.

200. Even in many of the larger cities there is need for providing better wholesale and retail marketing facilities. In some cases practically no facilities at all are available—even the most perishable foods are handled in the streets under conditions that may be unsanitary and lead to spoilage and serious loss of nutritive value. Proper facilities should be provided to encourage efficient marketing and to safeguard the nutritional and appetizing values of foods.

CONSUMPTION AND UTILIZATION PROGRAMS.

PURCHASING POWER

201. Producing and bringing to market a nutritionally adequate and reasonably priced supply of food is not the whole of the food problem. The food supply must there be met and absorbed by a population with purchasing power adequate to its needs. Hence measures to achieve full employment and adequate purchasing power are essential;

they have an important bearing on the distribution of food and the extent to which food supplies will come on the market.

202. The progressive diminution of poverty in all countries is an essential feature of the attack on malnutrition. Many of the factors associated with poverty in themselves limit the practical use of other methods described in this section. For instance, it is difficult by education alone to improve the diets of adults on the poverty line. Even if their food habits could be changed, bad housing, inadequate sanitary and cooking facilities, and sometimes insufficient fuel would make it almost impossible for them to apply their knowledge in practice.

203. Improving nutrition by increasing purchasing power of the low-income groups, however, takes time and is not easily accomplished. Education in proper food habits must go along with measures to increase income. Otherwise, a general increase in consumer purchasing power is a relatively slow and expensive way of improving nutrition because its effect is indirect. Until an equitable distribution of adequate purchasing power is attained, special measures for providing food for needy families, as well as schemes for making additional essential foods available to groups with special nutritional needs, together with education to improve dietary levels, must be relied upon. That is to say, their purchasing power must be extended in particular directions.

EDUCATION

204. One of the problems of food management is to find means of improving dietaries without depending solely on increasing purchasing power. If the household income is sufficiently above the poverty level, it is possible for the housewife to lay out her food budget in a variety of ways, and with care it is possible to purchase a relatively satisfactory or at least a better diet at modest cost. It is similarly possible for those who grow food for use in their own homes to plan their production with definite nutritional improvements in mind.

205. The part that education can play cannot be overemphasized. It is important not only in inducing families to make better use of their food resources through home production as well as wise money expenditures, but also in broadening support of public measures to improve nutrition.

206. The effectiveness of a broad program of education will depend to a great extent on the interest and support of community leaders. Part of the program, therefore, should be directed toward the "education" of these leaders. Teacher-training courses should include sound instruction in nutrition. Leaders in management and labor who understand the objectives of a nutrition program can be extremely helpful by promoting in-plant feeding and by encouraging the use of various educational devices for improving the nutrition of workers and their families.

207. Food education at school and publicity through illustrated news articles or pamphlets, films and radio, as well as through neighborhood groups for study and discussion will probably form a significant part of the food education program of Western countries. School meals, school milk, and in-plant or canteen feeding present opportunities

for education which should be fully utilized. It is useful to secure the cooperation of food retailers who are admirable media for food education displays, etc. At times, of course, educational programs will cut across the commercial interests of food traders and manufacturers, so one of the problems which may have to be faced is the conflict between the commercial exploitation of recent advances in nutritional science and educational nutrition projects.

208. Placing on the market food supplies consciously planned and priced to provide for good nutrition, increasing the consumer's purchasing power and educating the public to make wise food selections are all indirect methods of improving nutrition. Direct methods such as the distribution of milk and other important foods to vulnerable groups, the protection of the consumer against undesirable trade practices, and control of the processing of staple foods so as to retain or increase their nutrients have all been found in the United Kingdom, Canada, and the United States to be effective and relatively inexpensive methods of raising the nutritional status of the population.

SPECIAL MEASURES FOR VULNERABLE GROUPS

209. Childbearing women, infants, and young children are most prone to malnutrition; yet on their health depends the vitality of the next generation. It is generally agreed that they should be the first charge on any food program, either through general financial assistance or special allocation of nutritionally important foods at cheap rates or free. Relief and low-income families also need special measures to provide them with essential foods.

210. A great variety of methods has been used in different countries to make additional essential foods available to these vulnerable groups. These include school meals, low-price milk stations, food stamps, popular restaurants, and the direct distribution of food to relief families. These programs have been developed both as a means of supplying the foods needed by vulnerable groups, and to provide an outlet for agricultural surpluses.

211. The Hot Springs Conference in Resolution XXVII drew attention to the need for special international measures for wider food distribution. Nevertheless, the provision of adequate food is primarily the responsibility of each nation. Since undernutrition may continue for long periods in certain countries while they are developing their agriculture and industry, it would be desirable to make arrangements whereby a part of current world food supplies could be used to supplement the national food distribution programs of such countries.

212. The Hot Springs Conference recommended that FAO should study the possibility of devising measures for this purpose. It proposed that in such studies FAO should distinguish between methods that would be used in the case of famine following catastrophe, and in the case of a country where the available food supplies are generally inadequate. This recommendation raises problems of great importance which are discussed in paragraphs 161 and 162 of the report of the Technical Committee on Agricultural Production.

213. In many countries schemes for improving the diets of vulnerable families in need of public aid have been operated through the

provision of food in kind, rather than the provision of cash to buy food. The experience of social workers is that cash allowances are preferable to direct provision of food or food orders. The food-stamp plan in the United States permitted some choice and was more socially acceptable as well as less wasteful of food than the direct distribution of surplus foods. On the other hand, experience in the United Kingdom suggests that the special measures for vulnerable groups achieve a high degree of social acceptability and are not regarded as bearing the stigma of "relief." Further, it appears that milk for pregnant and nursing mothers and other direct methods of improving the nutrition of vulnerable groups may not only permit a better planned use of food resources but may be cheaper to the tax-payer and nutritionally more effective than direct financial assistance. The provision of school meals to all children and milk schemes for pregnant and nursing women as a right is not only a tribute to their potential value to the state but also a reflection of the desire to maintain the anonymity of public assistance.

214. These are relatively cheap methods of improving the diets of those whose need is greatest. In considering such schemes, governments will be largely concerned with their social acceptability, their cost, and the most suitable administrative techniques as well as with their agricultural and nutritional effects.

215. The Committee therefore recommends that FAO arrange for (a) a detailed study of special schemes for vulnerable groups—school meals, in-plant and canteen feeding, and other methods of distributing food to selected groups, and (b) a study of the relative merits of cash allowances versus food-in-kind in relief programs.

IMPROVING THE NUTRITIVE QUALITY OF FOOD

216. It is possible at little cost to improve diets without altering food habits or increasing food expenditure significantly. In cases where more expensive methods cannot be afforded and where education would be too slow, methods that accept existing food habits and improve the nutritive value of staple foods can be used. For example, the incorporation of soya products into sausage, bread, and prepared flour mixtures adds considerably to their nutritional value without changing their apparent character. The improvement of bread by the addition of milk solids and by the addition or greater retention of certain nutrients would also fall in this category. The cost of these additions is remarkably low in relation to the nutritional improvement achieved. There is a further possibility of enhancing the nutritive quality of food through better plant and animal breeding and improved marketing practices.

217. To date the agricultural scientist has concentrated on increasing yield per acre, per animal, and per man-hour, and on the commercial quality of farm products. The food technologist has been largely concerned with preserving and improving the palatability, appearance, keeping properties, and other commercial qualities of these products. In some cases, commercial quality is in conflict with nutritional quality. Agriculture and food manufacture have not yet fully reacted to the impact of the newer knowledge of food composition. It is necessary to develop a new concept of the terms "quality" and

"yield" to embrace nutrient content, as well as the existing commercial criteria, in agricultural and commercial thinking.

218. The Committee therefore recommends that FAO should suggest to governments the need for a comprehensive review of the present state of knowledge of the agricultural factors (including genetics, soil climate, farm management techniques) influencing the composition of foods.

CONSERVATION OF NUTRITIVE VALUE

219. One of the most economical ways of increasing a nation's or a family's supply of nutrients is through better conservation of those nutrients with which nature endows her foods. The original nutrient content may be greatly reduced before food is eaten either through removal of parts of the product, as in the milling of wheat or rice, or through the effects of heat, air, and water. Recent studies of the effects of processing, storage, and different methods of preparation show how great some of these losses may be. For example, in the preparation of patent flour about 85 percent of the original thiamine content is lost. Storage losses vary with storage time, temperature, and commodity. For example, onions held in dry, cool storage for three months have been shown to lose about half their ascorbic acid (vitamin C) content. In one study, freshly harvested leaf lettuce lost about half of its ascorbic acid when left at room temperature for twenty-four hours but only about 15 percent when held for the same time in a covered pan in a mechanical refrigerator. The more acid foods like tomatoes and citrus fruit seem to retain a very high proportion of their original ascorbic acid content. Losses due to cooking vary with the type of food, with different samples of the same food as well as with different methods of cooking.

220. Conservation of nutrients in the home should be approached not only through better methods of handling and preparing food but through elimination of wasteful practices such as excessive paring of fruits or vegetables, discarding edible outer leaves of green leafy vegetables (which may contain greater amounts of calcium, ascorbic acid, and vitamin A than the whiter inner portions), and unnecessary plate waste.

221. These facts point to the need for widespread information on the best methods of preserving and preparing food in the home as well as for more knowledge of the effects of commercial processing upon the retention of food values. They emphasize also the value of rapid transportation and proper storage in the marketing of fresh fruits and vegetables. Finally, the possibility of improving diets through lighter milling of grains, as has been done in the United Kingdom and Canada as a wartime measure, and through such processes as the parboiling of rice should not be overlooked. Conservation of the maximum amount of nutritive values available in foods may easily make the difference between a diet that is marginal with respect to several nutrients and one that is fully adequate.

FORTIFICATION

222. The fortification of staple foods is an inexpensive way of increasing the intake of specific nutrients. Fortification does not depend

upon the lengthy and difficult process of changing food habits. It is, however, not without possible dangers. We do not yet know enough about all the nutrients required for human health and vigor, nor do we know what effect the addition of chalk, for example, may have on the physiological availability of other essential nutrients in bread. Nevertheless, the value of adding iodine to salt; iron, vitamin B₁, riboflavin, and niacin to white bread; vitamins A and D to margarine; and vitamin D to milk appears to be well established. Fortification should not be undertaken lightly but it is a weapon which we cannot afford to neglect.

223. The Committee therefore recommends that FAO should be ready on request to assist governments in studies of the health, nutritional, technical, economic, and legal aspects of fortification, and of the possibilities of improving diets through better conservation of the nutritive values of foods.

PROTECTION OF THE CONSUMER

224. Most governments provide some marketing services, including the enforcement of pure-food laws, the development of grades and standards, and the dissemination of market news. These services ought to be strengthened, and there is particular need for coordinating them so as to contribute more effectively to international trade in foods.

225. Pure-food laws have been concerned mainly with preventing adulteration and misrepresentation and the distribution of unhealthful foods. Most Western countries now have public health legislation to prevent the presence of toxic substances or microorganisms in food. Some also have legislation to prevent misleading advertising or misdescription of food and medicines. In few cases are these laws framed with any positive nutritional purpose, although they do affect consumption to some extent by creating consumer confidence in the safety of foods like milk, canned goods etc.

226. Official grades and standards have come into general use in some countries with highly specialized commercial agriculture. They have demonstrated their value in bringing about greater efficiency in marketing and distribution and also in adjusting the quality of foods to consumer preferences and budgets. Standardization, grading, and food inspection need to be strengthened and extended in practically all countries, particularly by the greater use of grades at the retail level. Moreover, there is a need for international grades and standards for certain agricultural commodities and for the development of suitable measures for enforcing these grades and standards through impartial inspection services.

227. The rapid development of nutritional science has brought substantial benefits to the consumer, but the stressing of commercial as distinct from nutritional quality and elaborate publicity on the supposed nutritional benefits of many relatively expensive manufactured or processed foods may have adverse effects by causing imbalance of the consumer's food expenditure. The Committee recommends, therefore, that FAO make a comparative international survey of the scientific, technical, commercial, and legal aspects of food content, description and grading, and advertising, for the information of governments.

ADMINISTRATION

228. The resolutions and reports of the Hot Springs Conference imply some degree of economic guidance by governments in the interests of better nutrition. The Committee's study of three countries with wartime food policies confirms this implication, but suggests that the scale of intervention is substantially determined by the administrative techniques used. The acceptability of a planned nutrition policy to consumers, traders and farmers depends in large part on the adaptation of administrative methods to the needs and susceptibilities of the groups concerned. Thorough study of administrative techniques should be an integral part of other studies recommended in this report.

7. RESEARCH AND INVESTIGATION

GENERAL CONSIDERATIONS

229. In final analysis, continued progress in nutrition will result from advances in knowledge made possible by fundamental research. Not until beriberi was found to be caused by the lack of sufficient amounts of a particular nutrient in the diet of its victims did it become possible to prevent as well as to cure the disease. No great progress could be made against pellagra until research had shown that it resulted from a diet deficient in niacin. Further research revealed the chemical structure of thiamine and of niacin, and made it possible to manufacture these nutrients in pure form. Some progress in nutrition may be made by applying on a wider scale our present knowledge of the subject. But far greater progress may be expected if such fundamental research is encouraged and extended. While knowledge of nutrition has grown by leaps and bounds during the last quarter of a century, we have scarcely begun to explore the subject. Hence the relation of FAO to fundamental research is a matter of great concern, and while such research will continue to be carried on in research institutes of various types throughout the world, it will be in the interest of FAO to keep in the closest touch with such institutes and to encourage this work in every possible way.

230. On a less fundamental scale, research and invention can increase food resources and improve their utilization. Hence, the quality of human life will be determined to an increasing extent by scientific method of thought and scientific discovery. The effectiveness of the scientific attitude is not restricted to the natural sciences, but is of proven value in the approach to social, economic, and psychological problems.

231. It is appropriate, therefore, to consider together the various aspects of food and nutrition concerning which continued scientific inquiry appears likely to yield results of value. On the one hand, there are the several fields of research directed toward (a) human food requirements and the foods by which they can be satisfied, (b) improvement of methods by which food commodities can be handled and treated in order best to satisfy these requirements, and (c) improvement of food production and food products. These fields are referred to below as nutritional science, food science, and agricultural science. There exists also that broad field of potential study, only in

part of strictly scientific character, which relates to man's desires (as distinct from his physiological requirements) with regard to food. There are also the several fields embracing the social and economic aspects of food, including the economics of food production and distribution and of food management in the home and in the community.

232. Our purpose is to indicate the character of the various broad fields of study, rather than specific subjects for investigation, which promise to yield results of value to governments in improving food management programs.

NUTRITIONAL SCIENCE

233. Estimates of requirements for foods must take into account not only the physiological needs for nutrients, but the psychological aspects of food and food habits as well.

234. Accurate interpretation of the adequacy of food supplies depends on knowledge of requirements and on reliable data about the nutritive value of foods. The interpretation of nutrient requirements in terms of foods and diets rests upon food composition data. A table of dietary requirements in terms of nutrients has general application only as a common basis for evaluating and expressing the necessary nutrient composition of the whole diet. International comparisons of food resources and needs must rest on a common basis of food evaluation. Discussions are already taking place to develop a table of food composition that will be acceptable to the United Kingdom, Canada, and the United States. Clearly all values used by different countries should have a common scientific basis. For example, international agreement on the basis of computing calories is needed, as is collaborative research both to improve the analytical procedures employed in determining nutrient content, and to enlarge and make more reliable present data on the composition of the world's food products.

235. Estimates of dietary adequacy calculated by applying food composition factors to consumption data need to be supplemented by laboratory and clinical assessment of nutritional status. Considerable progress has been made in the development of rapid methods of detecting early clinical deficiencies. Much more research is needed to clarify the significance of the methods now employed and to extend, to improve, and to apply them to large samples of the population. All of these investigations will contribute toward the establishment of more precise dietary requirements.

236. A very large part of our present nutrition knowledge rests upon short-and long-term experiments on animals or short-time studies and observations of human beings. The long-time effects of various dietary regimes upon human health and physical and mental well-being are in urgent need of elucidation. However, human studies can never displace entirely the more closely controlled and extensive studies covering generations made possible by the use of suitable laboratory animals.

237. The Committee therefore recommends that FAO give early attention to the following research problems in the field of nutritional science :

- (1) Reassessment of the physiological bases of nutrition in the light of the latest scientific research and wartime experience, in

order to provide for use by all countries tables of dietary requirements in terms of nutrients.

(2) Establishment of a common scientific basis for the determination and expression of nutritive values of foods which will be fundamentally comparable as set forth in the food composition data of different countries, the improvement of the techniques of food assay, and the determination of further and more reliable data on the nutrient composition of the world's food supply.

(3) Studies for the further development and improvement of clinical methods for the assessment of nutritional status, and studies of the application of these methods to large samples of the population.

(4) The long-time effects of diet upon health and physical and mental well-being with emphasis on studies of human subjects.

(5) The physiological and psychological bases of appetite and food habits and their relation to food requirements.

FOOD RESEARCH

238. The term "food research" is used here to include the broad field in which the concepts and techniques of the relevant sciences are applied to elucidate the properties of foodstuffs and their behavior under various treatments and conditions. Past experience has demonstrated that research in this field should not be restricted to short-range investigations directed to specific practical objectives, but that it is essential to encourage the accumulation of a body of fundamental knowledge regarding the changes that occur in living and nonliving foods under varying conditions.

239. Such research is necessary not only to favor the development of first-class scientific talent and imagination, but also to provide the basic knowledge that will suggest and guide innovations in practice. Examples to illustrate this point of view include the development and perfecting of canning based upon knowledge of the microorganisms causing food spoilage; the development of cold storage based upon knowledge of the effects of temperature upon both living and nonliving foodstuffs; methods of storing and transporting fruits in appropriate gas mixtures based upon an understanding of the effects of atmospheric composition and temperature upon the metabolism of different varieties of fruit; and improvements in the keeping properties of various classes of dehydrated foodstuffs based upon an understanding of the nature of the chemical changes in these commodities in the "dry" state.

240. The extension of food research and the fuller application of its findings can make important contributions toward the improved utilization of food resources, particularly if practical objectives are selected which are related to nutritional needs on the one hand, and to the trends and possibilities in the field of agricultural research on the other. Apart from important nutritional benefits from improved handling and processing of foods, it is clear that investigations of the physical and chemical basis of palatability might contribute to our knowledge of food habits and lead to the invention of methods for converting unpalatable but cheap and nutritious raw foodstuffs into palatable products.

241. Important as is the approach to food research outlined in the preceding paragraphs, it is after the food has reached the kitchen that the greatest nutrient losses often occur. Cooking is an art that can be aided by science. While its appeal is to the appetite, good cooking should also preserve nutrient qualities and tend to eliminate waste. Too little is as yet known about the effect of flavor on appetite and assimilation. The Committee suggests that FAO should encourage further research both into this subject and into the methods for securing widespread improvements in cooking methods.

242. Thus, the broad objectives of food research as a means of ensuring the best use of available food resources are (a) to eliminate wastage by spoilage, destruction, or loss of nutrients during processing (before and after reaching the kitchen); (b) to ensure that the most economical and efficient technical methods are available to the various branches of the food industry and for the preservation and management of food in the home, so that the consumer's requirements and desires for a health-giving and attractive diet can be satisfied at the lowest cost; and (c) to provide the basic scientific knowledge required in the framing of regulations for protection of the consumer with regard to the quality and nutritional value of his food.

243. The Committee therefore recommends that FAO should arrange, in the light of these objectives, for an authoritative review of the application of science to the preservation, storage, transport, processing, and cooking of food. The object would be to produce in this field an authoritative report of wide scope, rather than a series of detailed analyses of, for instance, the present state of scientific knowledge about dehydration.

AGRICULTURAL RESEARCH¹

244. History shows that increased food supply and improved nutrition depend substantially on technological advances in food production. Increased output per unit of land and labor potentially increases the total food supply or permits resources previously devoted to cereals and starchy roots to be diverted to livestock and protective foods.

245. Agricultural research has therefore an importance as great as, if not greater than, nutritional and food research. "Better nutrition," stated the Hot Springs Conference, "means better farming," and the latter depends in large part on agricultural research and invention.

246. The outstanding contributions of agricultural research to farming have been mainly along the lines of improved mechanical equipment, better management of soil and water and of crops and livestock, improvement of crops and livestock through breeding, better feeding of farm animals, better control of diseases and of insect and other pests, and better handling and processing of farm products. Underlying these practical advances have been many fundamental discoveries in the physical and biological sciences; and the economic and social sciences, in turn, are being called on more and more to make possible the rapid and widespread use of better practices in farming. Continued research in all of these fields can be expected to make

¹ For a fuller treatment of this subject see *Agricultural Production—Report of the Technical Committee on Agricultural Production*.

further important contributions to the improvement not only of the food supply but of human welfare in general.

MARKETING RESEARCH

247. Governments, administrators, and traders cannot take full advantage of scientific research without adequate knowledge of the social and economic factors that favor or limit the application of science in practice. Therefore, social and economic research is an essential counterpart of scientific research in creating the knowledge on which sound food policies must be based.

248. There are two subjects in this wide field that deserve immediate study: (1) the relative costs of different methods of food preservation and transportation, and (2) the narrowing of the margin of cost between producer and consumer by the reduction of unessential services.

249. The rapid wartime developments in food science and in its practical application to food problems have been made under conditions whereby the test of a program or a product was, "Will it help to win the war?" rather than, "What will it cost?" Many of these developments are potentially of great nutritional significance. It is important to find out whether these new products and processes are likely after the war to be able to compete with old-established habits. For instance, is it likely that a cheaper winter egg supply could be provided by using eggs dried in spring and summer, the period when the fresh egg supply is cheapest and most plentiful? A similar question arises with respect to milk. Again, in most Western countries fresh vegetables are costly to produce and in short supply in the early spring. What are the economics and nutritive value of fresh green winter vegetables as compared with quick-frozen? In most cases clear-cut answers to such questions will not be possible, but even incomplete data are likely to prove of value to governments, producers, traders, and consumers.

250. The Committee therefore recommends that FAO should examine, on a wide basis, the comparative costs of currently available methods of preserving and transporting food products of animal origin and fresh vegetables and fruits.

251. The war has, in many countries, forced the consumer to forego some of the services he normally receives from the retailer. Deliveries to the household have been reduced, "cash and carry" has become more frequent, elaborate packages have been simplified, complex products have been simplified or eliminated, brand advertising in some countries has been reduced. If continued into the peace, such savings should help to reduce the margin between the producer and the consumer and thus improve nutrition. There was a tendency before the war for unessential services of this type to multiply and to raise retail prices. While this trend did no harm to the well-to-do consumer and helped to provide employment, it probably tended to prejudice the nutritional status of the poorer consumer. At the same time, consumers have a right to expect, and will no doubt insist upon a reasonably high standard of retail service. Simplification of products has in some cases reduced palatability and variety, thereby decreasing consumption. The reduction or elimination of certain retail services has increased the burden upon housewives and left them less time and energy to plan and prepare attractive, wisely chosen meals.

252. The Committee therefore recommends that 'FAO should take this opportunity of investigating—when unessential retail services have in many countries been reduced to save labor, transport, packaging, etc.—possible methods of reducing the margin between producer and consumer by the reduction of such unessential services as do not contribute indirectly to good nutrition. This does not preclude the need to study improvements in the efficiency of essential services.

FAMILY FOOD MANAGEMENT

253. Since food is only one item in the family budget, although in workers' households usually the largest, the needs and desires of the family for housing, medical care, clothing, and other items influence the pattern of food expenditures. Families need guidance in spending wisely not only their food money but also the rest of their income. Simple methods of teaching nutrition in terms of common foods are especially needed. Along with such teaching, emphasis should be given to the methods of food preparation most effective in conserving nutrients and improving palatability. An important factor affecting selection is the housewife's desire for convenience. Since suitability for storage, palatability, and ease of preparation often outweigh nutritional considerations, plans for family guidance must take these factors into account.

254. The ultimate test of successful national food management rests in its application and acceptance in the home. Family food habits are difficult to change quickly. Wartime experience in the United Kingdom has shown that much can be accomplished gradually by changes that are not too drastic, enabling families to make better use of the available food resources and to make the food budget go further. The school meal is one of the most useful means of changing food habits, but others need to be explored in order to arrive at conclusions concerning the most effective techniques for different groups of people and the possibilities of handling them successfully. Most can be accomplished when emphasis is placed on adjustment by each family in accordance with its individual habits and preferences. Just so must it be with nations. It is probable that the systematic study of food habits may bring into being basic concepts that will be of value in suggesting educational and other means designed to bring about desirable changes in diets. Particularly is this true if it proves possible to establish the nature and the relative importance of the psychological and physiological factors upon which food habits depend, and the relationship between these factors and the inherent qualities of foodstuffs which evoke particular reactions from different consumers.

255. Periodic measurement of the kinds and quantities of food that families at different income levels are consuming is important for the successful operation of a national nutrition program. Toward this end, many types of dietary surveys can and should be made.

256. The Committee therefore recommends that FAO should (1) assist governments to make family dietary surveys and studies of the relation of the family's food expenditures to its other expenditures, (2) further the study of the problem of developing effective ways of modifying food habits to make the best use of the family food budget as well as of national food resources, and (3) aid in the formulation of nutritionally adequate food plans for families in different countries.

PROVISION OF TRAINED PERSONNEL

257. It is appropriate in this section to consider the future supply of trained personnel for education, research, and technical administration as well as for industry. National food management has come into its own during the war. The war has emphasized also the necessity for a wider appreciation of the interdependence of agricultural, food, and nutritional sciences upon each other and upon social and economic research. The Committee does not feel that it is within its scope to make detailed recommendations concerning the training and provision of trained personnel in food management and in the sciences associated with food and agriculture. But it suggests that FAO should arrange for the preparation by an appropriate committee of a report on the above subject for the use of governments and universities. The preparation of such a report will inevitably take time; meanwhile there is scope for early action which need not await its completion. Under present conditions there is more work for agricultural and nutritional scientists than there are trained men to undertake it. As the principles of food management become more widely appreciated, the demand may be expected still further to exceed the supply. The Committee does not believe that the initial lack of a coordinated plan should be allowed to delay an increase in the number of workers in these subjects.

258. The Committee therefore recommends that FAO should invite governments to anticipate the report by providing greater facilities for the study of subjects embraced by and associated with food management, and by giving positive encouragement to future students to make use of the facilities.

FOOD MANAGEMENT IN RELATION TO NATIONAL ADMINISTRATIONS,
UNIVERSITIES, AND RESEARCH INSTITUTIONS

259. For the same reason that the Committee has suggested that attention be paid to the training of research workers in food management, it is believed that many governments, universities, and research institutions would find it useful to review the present relations between nutritional, food, and agricultural sciences and the related economic and social studies, in the regions for which they are responsible. On the part of nutritional science there has been an inadequate appreciation of the practical value of the principles of nutrition and physiologic requirements as they affect the production and processing of foods in which many other scientific activities are involved. There should be an opportunity during the reconstruction period to improve the training of research workers so as to give a better understanding to all concerned of the interrelations among nutritional, agricultural, and food sciences.

INTERNATIONAL CONFERENCES

260. It is believed that research workers in food and agriculture would benefit from the stimulus and increased breadth of view which international research conferences on the different aspects of food management would supply.

261. The Committee therefore recommends that FAO consider the advisability and practicability of convening groups, committees, or conferences periodically and that it facilitate the exchange of national experience and information on the widest possible front.

PART III. RECOMMENDATIONS

262. It is perhaps difficult for those directly concerned with war-time food and agricultural problems yet to appreciate in full the peacetime value of the food management techniques that they have created and tested during the war. The war has shown conclusively that, by applying administrative skill and scientific knowledge to the use of food resources, great nutritional improvements are potentially possible in many areas of the world.

263. There is every reason to believe that many of the beneficial devices used in wartime also could be successfully used in peacetime in Western countries, without excessive control of economic life and of the individual and without excessive cost. Though progress may be slower, some of these devices can be (indeed some of them have been) successfully applied in less developed countries. While rich countries with ample supplies of protective foods and high standards of living cannot afford to neglect these new techniques, in countries with lower standards of living or restricted food supplies integrated food management programs are essential for nutritional progress.

264. In the preceding sections various suggestions have been made as to action which might be undertaken by FAO. These suggestions are collated in the following recommendations :

(1) International surveys by FAO of existing conditions.

The Committee recommends that FAO should :

(a) Undertake, as soon as practicable, detailed studies of the technique of measuring and comparing the food consumption and nutritional status of Western and less developed countries.

(b) As statistics are absolutely essential to the full and proper utilization of food resources, pay particular attention to the type of statistical material required for the practical and actual satisfaction of nutritional needs in both Western and less developed countries.

(c) Arrange for a detailed study of special food distribution schemes for vulnerable groups (school lunches, in-plant and canteen feeding, and other methods of distributing food to selected groups).

(d) Arrange for a study of the relative merits of cash allowance versus food-in-kind in relief programs.

(e) Examine, on a wide basis, the comparative costs of currently available methods of preserving and transporting food products of animal origin and fresh vegetables and fruits.

(2) International studies by FAO of potentialities for progress.

The Committee recommends that FAO should :

(a) In collaboration with appropriate international commercial and financial organizations, study methods of increasing international trade in food and feedingstuffs.

(b) Take this opportunity—when unessential retail services have in many countries been reduced to save labor, transport, packaging, etc.—of investigating possible methods of reducing the margin between the producer and the consumer by the reduction of such unessential services. This should not preclude the need to study improvements in the efficiency of essential services.

(3) **National studies.** The Committee recommends that FAO should :

(a) In the light of the international studies (Recommendation (1) (a)) invite every government, through its national nutritional organization (the setting up of which was recommended at the Hot Springs Conference) jointly with other appropriate national authorities, to survey in detail its own resources in relation to its over-all needs; and, on the basis of this survey, to draw up an integrated nutrition, food, trade and agricultural program.

(4) **Specific means of assistance by FAO.** The Committee recommends that FAO should :

(a) For the purpose of Recommendation (3) (a), prepare itself at an early stage to supply technical information and to give advice to governments on nutrition and related matters.

(b) Be ready on request to assist countries in studies of the possibilities of improving diets through better conservation of the nutritive value of foods.

(c) Assist governments to make family dietary surveys and studies of the relation of the family's food expenditures to its other expenditures for living.

(d) Further the study of the problem of developing effective ways of modifying food habits to make the best use of the family budget as well as of national food resources.

(e) Aid in the formulation of nutritionally adequate food plans for families in different countries.

(f) Arrange for the preparation by an appropriate committee of a report on the training and provision of trained personnel in the field of food management and in the sciences and humanities associated with food and agriculture.

(g) Invite governments to anticipate the report by providing greater facilities for the study of food management and allied subjects, and by giving positive encouragement to future students to make use of the facilities.

(h) Consider the advisability and practicability of convening periodically groups, committees, or conferences and facilitate the exchange of national experience and information on the widest possible front.

(5) **Scientific and technical research.** The Committee recommends that FAO :

(a) Should encourage governments to develop the technique of measuring the relative efficiency of domestic and imported foods in supplying nutrients, in terms of land, labor, monetary, and/or other resources, and should on request assist governments in this work.

(b) Should suggest to governments the need for a comprehensive review of the present state of knowledge of agricultural factors (including genetics, soil, climate, farm management techniques) that influence the composition of foods.

(c) Should be ready on request to assist governments in studies of the health, nutritional, technical, economic, and legal aspects of fortification.

(d) Should make a comparative international survey of the scientific, technical, commercial, and legal aspects of food content, food description and grading, and food advertising, for the information of governments.

(e) Should encourage experimental research on plant and animal breeding leading toward a larger amount or higher nutritional quality of food for the same resources of land and labor.

(f) Should give early attention to the following research problems in the field of nutritional science :

(i) reassessment of the physiological bases of nutrition in the light of the latest scientific research and wartime experience to provide tables of dietary requirements for use by all countries in terms of nutrients ingested ;

(ii) establishment of a common scientific basis for the determination and expression of nutritive values of foods which will be fundamentally comparable as set forth in the food composition data of different countries, for the improvement of the techniques of food assay, and for the determination of further and more reliable data on the nutrient composition of the world's food supply ;

(iii) further development and improvement of clinical methods for the assessment of nutritional status and of the application of these methods to large samples of the population ;

(iv) long-time effects of diets upon health and physical and mental well-being with emphasis on studies with human subjects ;

(v) physiological and psychological bases of appetite and food habits and their relation to food requirements.

(g) Should arrange for an authoritative review of the application of science to the preservation, storage, transport, and manufacture of food. The object would be to produce, in this field, a report comparable in authority to and wider in scope than the League of Nations' *Report on the Physiological Bases of Nutrition*¹ rather than a series of detailed analyses of, for instance, the present state of scientific knowledge about dehydration.

¹ League of Nations, Health Committee, Technical Commission, *Report on the Physiological Bases of Nutrition*, Geneva, 1936.

APPENDICES

I. SUPPORTING TABLES

TABLE 1.—NUTRIENTS AVAILABLE FOR CIVILIAN CONSUMPTION PER CAPUT PER DAY, UNITED KINGDOM, 1934—1938

Item	Calories (No.)	Protein (Gr.)	Fat (Gr.)	Carbo- hydrates (Gr.)	Calcium (Mg.)	Iron (Mg.)	Vitamin A (I. U.)	Ascorbic acid (Mg.)	Thiamine (Mg.)	Riboflavin (Mg.)	Niacin (Mg.)
Dairy products	272	13.8	15.3	19.6	481	0.4	530	4.5	0.15	0.62	0.4
Meats	486	18.4	45.9	.2	9	4.1	627	...	.33	.39	9.9
Poultry, game, and fish	43	6.9	1.7	...	17	.6	13	...	.02	.03	1.2
Eggs	39	3.5	2.8	.1	16	.8	105	...	.04	.13	...
Fats and oils	510	.2	56.6	...	5	.1	1,386	...	...	...	...
Sugars and syrups	465	...	...	116.0	2	...	...	...	...	...	...
Potatoes	123	3.6	...	27.1	14	1.3	...	24.7	.21	.09	2.2
Dried pulses and nuts	40	2.7	1.3	4.3	10	.6	2	...	.06	.04	.5
Tomatoes and citrus fruit	12	.4	...	2.7	13	.1	192	19.5	.02	.01	.2
Other fruits	51	.5	...	12.2	15	.5	34	8.8	.03	.06	.3
Leafy, green, and yellow vegetables	12	1.4	...	1.6	35	.5	942	37.0	.08	.05	.4
Other vegetables	10	.5	...	2.1	19	.2	...	6.8	.01	.03	.1
Grain products	899	28.1	3.0	189.9	46	3.0	...	...	.22	.11	2.3
Beverages	25	.3	2.5	.5	1	.2	...	...	...	...	...
TOTAL	2,987	80.3	129.1	376.3	683	12.4	3,831	101.3	1.17	1.56	17.5

SOURCE : Combined Food Board, Special Joint Committee, *Food Consumption Levels in the United States, Canada and the United Kingdom*, Second Report, December 1944, Table 12.

TABLE 2.—NUTRIENTS AVAILABLE FOR CIVILIAN CONSUMPTION PER CAPUT PER DAY, UNITED KINGDOM, 1943

Item	Calories (No.)	Protein (Gr.)	Fat (Gr.)	Carbo- hydrates (Gr.)	Calcium (Mg.)	Iron (Mg.)	Vitamin A (I. U.)	Ascorbic acid (Mg.)	Thiamine (Mg.)	Riboflavin (Mg.)	Niacin (Mg.)
Dairy products	316	18.1	18.6	19.6	629	0.55	639	5.7	0.19	0.81	0.49
Meats	367	14.8	34.2	.2	8	3.31	473	...	.25	.31	7.45
Poultry, game, and fish	31	4.9	1.3	...	12	.44	9	...	.02	.02	.87
Eggs	33	3.0 ^a	2.3	.1	14	.69	92	...	.02	.11	.02
Fats and oils	428	.1	47.5	...	2	.10	678	...	...	...	...
Sugars and syrups	318	...	...	79.4	1	.01	1	.2	...	...	...
Potatoes	194	5.5	...	42.9	21	1.88	...	38.2	.32	.14	3.37
Dried pulses and nuts	24	2.4	.3	2.8	11	.52	1	...	.04	.03	.29
Tomatoes and citrus fruit	4	.2	...	.9	3	.07	122	...	.01	.01	.08
Other fruits	29	.3	...	7.0	10	.28	20	5.3	.02	.03	.21
Leafy, green, and yellow vegetables	17	2.0	...	2.4	51	.75	1,658	52.7	.11	.07	.67
Other vegetables	15	.7	...	3.0	27	.27	...	9.8	.02	.04	.13
Grain products	1,060	35.7	7.2	213.2	255	7.12	...	...	.92	.49	5.24
Beverages	25	.6	2.2	.8	1	.41	1	...	...	...	...
TOTAL	2,861	88.3	113.6	372.3	1,045	16.40	3,694	117.2	1.92	2.06	18.82

SOURCE: Combined Food Board, Special Joint Committee, *Food Consumption Levels in the United States, Canada and the United Kingdom*, Second Report, December 1944, Table 13.

TABLE 3.—NUTRIENTS AVAILABLE FOR CIVILIAN CONSUMPTION PER CAPUT PER DAY, CANADA, 1935-1939

Item	Calories (No.)	Protein (Gr.)	Fat (Gr.)	Carbo- hydrates (Gr.)	Calcium (Mg.)	Iron (Mg.)	Vitamin A (I. U.)	Ascorbic acid (Mg.)	Thiamine (Mg.)	Riboflavin (Mg.)	Niacin (Mg.)
Dairy products	381	20.3	21.3	27.0	677	1.1	1,149	8.9	0.17	0.97	0.6
Meats	404	19.7	36.0	.2	13	3.6	525	1.3	.86	.36	.8.3
Poultry, game, and fish	57	6.3	3.5	...	6	.9	22	.6	.03	.05	1.6
Eggs	53	4.3	3.8	...	18	.9	335	0	.07	.12	...
Fats and oils	463	.3	51.2	.2	6	.1	574	0	...	...	...
Sugars and syrups	506	(a)	0	126.4	18	.4	0	0	(b)	.01	(c)
Potatoes	176	4.3	.3	39.2	16	1.5	105	20.5	.18	.10	2.4
Pulses and nuts	66	3.6	2.2	8.0	15	1.1	4	0	.11	.05	.6
Tomatoes and citrus fruit	18	.5	.1	3.8	11	.3	342	11.7	.05	.02	.3
Other fruits	65	.5	.3	15.1	10	.5	199	3.7	.03	.04	.3
Leafy, green, and yellow vegetables	17	.8	.1	3.4	17	.2	2,876	8.2	.04	.04	.4
Other vegetables	17	.5	.1	3.6	10	.2	29	5.2	.01	.02	.1
Grain products	938	28.9	2.9	199.1	59	4.1	2	0	.41	.15	2.4
Beverages	21	.2	1.9	.7	3	.1	0	0	...	0	0
TOTAL	3,182	90.2	123.7	426.9	879	15.0	6,162	60.1	1.96	1.93	1.78

SOURCE: Combined Food Board, Special Joint Committee, Food Consumption Levels in the United States, Canada and the United Kingdom, Second Report, December 1944, Table 9.

(a) Less than 0.05 gram.

(b) Less than 0.005 milligram.

(c) Less than 0.05 milligram.

TABLE 4.—NUTRIENTS AVAILABLE FOR CIVILIAN CONSUMPTION PER CAPUT PER DAY, CANADA, 1943

Item	Calories (No.)	Protein (Gr.)	Fat (Gr.)	Carbo- hydrates (Gr.)	Calcium (Mg.)	Iron (Mg.)	Vitamin A (I. U.)	Ascorbic acid (Mg.)	Thiamine (Mg.)	Riboflavin (Mg.)	Niacin (Mg.)
Dairy products	447	23.9	24.9	31.8	796	1.3	1,488	10.3	0.20	1.15	0.7
Meats	534	25.0	48.1	.2	16	4.6	692	1.7	1.20	.47	10.9
Poultry, game, and fish	71	7.8	4.3	...	8	.7	27	.7	.04	.05	1.9
Eggs	61	5.0	4.4	.3	21	1.1	390	0	.08	.14	...
Fats and oils	468	.2	51.9	.2	6	.1	517	0	(a)	(a)	.1
Sugars and syrups	433	(b)	0	108.1	20	.5	0	0	(a)	.01	(c)
Potatoes	185	4.5	.3	41.3	17	1.6	109	21.6	.19	.11	2.5
Pulses and nuts	55	3.3	1.0	8.0	15	1.2	3	...	.10	.05	.5
Tomatoes and citrus fruit	25	.7	.2	5.5	16	.3	354	15.7	.06	.02	.4
Other fruits	58	.4	.3	13.5	9	.5	177	3.9	.03	.04	.3
Leafy, green, and yellow vegetables	16	.8	.1	3.0	14	.4	2,461	7.4	.03	.03	.4
Other vegetables	13	.4	.1	2.7	7	.2	22	3.9	...	.02	.1
Grain products	1,018	31.5	3.1	216.1	64	4.5	2	0	.44	.16	3.1
Beverages	17	.2	1.5	.6	2	...	0	0	...	0	0
TOTAL	3,401	103.7	140.2	431.3	1,011	17.0	6,242	65.2	2.37	2.25	20.9

SOURCE: Combined Food Board, Special Joint Committee, *Food Consumption Levels in the United States, Canada and the United Kingdom*, Second Report, December 1944, Table 10.

(a) Less than 0.005 milligram.

(b) Less than 0.05 gram.

(c) Less than 0.05 milligram.

TABLE 5.—NUTRIENTS AVAILABLE FOR CIVILIAN CONSUMPTION PER CAPUT PER DAY, UNITED STATES, 1935—1939

Item	Calories (No.)	Protein (Gr.)	Fat (Gr.)	Carb- hydrates (Gr.)	Calcium (Mg.)	Iron (Mg.)	Vitamin A (I. U.)	Ascorbic acid (Mg.)	Thiamine (Mg.)	Riboflavin (Mg.)	Niacin (Mg.)
Dairy products	367	19.5	20.9	25.5	650	1.2	1,045	6.7	0.15	0.90	0.5
Meats (a)	399	20.3	35.2	.3	12	3.3	704	.8	.74	.35	6.8
Poultry, game, and fish	51	6.1	2.9	.1	6	.5	10	.7	.03	.02	1.6
Eggs	60	4.9	4.4	.3	21	1.0	384	0	.08	.19	(b)
Fats and oils	50.4	.2	55.7	.1	3	(b)	756	0	(c)	(c)	0
Sugars and syrups	515	(d)	0	128.6	11	.3	0	.2	(c)	(c)	0
Potatoes	139	3.1	.3	31.0	25	1.1	907	18.4	.14	.08	1.8
Dry beans, peas, soybeans, and nuts	83	4.2	3.6	8.4	21	1.3	2	0	.11	.06	1.0
Tomatoes and citrus fruit	32	.7	.2	6.9	18	.4	531	26.4	.07	.03	.4
Other fruits	108	.9	.4	25.0	19	.8	730	11.3	.06	.09	.6
Leafy, green, and yellow vegetables	31	1.6	.2	5.8	33	.8	1,681	31.4	.08	.06	.5
Other vegetables	40	1.3	.3	7.9	22	.4	38	9.5	.04	.06	.2
Grain products	887	25.8	3.0	189.0	41	3.0	16	0	.27	.13	2.3
Beverages	22	.2	1.9	.8	3	.1	0	0	(c)	0	0
TOTAL	3,236	88.8	129.0	29.7	885	14.2	6,804	105.4	1.77	1.97	15.7

SOURCE: Combined Food Board, Special Joint Committee, Food Consumption Levels in the United States, Canada and the United Kingdom, Second Report, December 1944, Table 6.

- (a) Includes fat pork cuts.
 (b) Less than 0.05 milligram.
 (c) Less than 0.005 milligram.
 (d) Less than 0.05 gram.

TABLE 6.—NUTRIENTS AVAILABLE FOR CIVILIAN CONSUMPTION PER CAPUT PER DAY, UNITED STATES, 1943

Item	Calories (No.)	Protein (Gr.)	Fat (Gr.)	Carbo- hydrates (Gr.)	Calcium (Mg.)	Iron (Mg.)	Vitamin A (I. U.)	Ascorbic acid (Mg.)	Thiamine (Mg.)	Riboflavin (Mg.)	Niacin (Mg.)
Dairy products	430	22.7	24.5	30.1	754	1.3	1,223	8.2	0.17	1.05	0.5
Meats (a)	471	22.5	42.1	.4	13	3.7	1,010	.1	.92	.42	7.5
Poultry, game, and fish	60	6.8	3.7	.1	6	.7	7	.1	.03	.02	2.0
Eggs	68	5.6	4.9	.3	23	1.2	432	0	.09	.22	(b)
Fats and oils	484	1.3	53.7	.1	2	(b)	588	0	(c)	.01	0
Sugars and syrups	454	(d)	0	113.3	15	.4	0	.3	(c)	(c)	0
Potatoes	138	3.1	.3	30.9	25	1.1	886	18.	.14	.08	1.8
Dry beans, peas, soybeans, and nuts	109	5.9	4.7	10.8	28	1.7	7	0	.16	.08	1.4
Tomatoes and citrus fruit	39	.8	.8	8.4	22	.4	580	32.6	.08	.03	.5
Other fruits	82	.7	.3	19.1	15	.6	526	8.1	.04	.06	.5
Leafy, green, and yellow vegetables	37	1.9	.2	6.9	38	.9	2,034	35.8	.09	.08	.6
Other vegetables	44	1.4	.3	8.6	24	.4	42	10.0	.04	.07	.2
Grain products	912	26.5	2.9	194.5	41	4.0	20	0	.73	.21	3.6
Beverages	14	.2	1.3	.5	2	(b)	0	0	(c)	0	0
TOTAL	3,342	99.4	139.2	424.0	1,008	16.4	7,355	113.5	2.49	2.33	18.6

SOURCE: Combined Food Board, Special Joint Committee, *Food Consumption Levels in the United States, Canada and the United Kingdom*, Second Report, December 1944, Table 7.

(a) Includes fat pork cuts.

(b) Less than 0.05 milligram.

(c) Less than 0.005 milligram.

(d) Less than 0.05 gram.

TABLE 7.—CROP ACREAGE HARVESTED AND LIVESTOCK POPULATION ON FARMS^a
IN THE UNITED KINGDOM, CANADA, AND THE UNITED STATES, PREWAR YEARS,
1942, 1943, AND 1944

Commodity	Unit	Prewar ^b	1942	1943	1944
UNITED KINGDOM					
Wheat	1,000 acres	1,856	2,516	3,461	3,230
Barley	"	929	1,528	1,784	1,989
Oats	"	2,403	4,133	3,678	3,684
Mixed grain	"	97	546	501	426
Pulses for stock-feeding	"	159	292	314	347
Potatoes	"	723	1,304	1,391	1,421
Sugar beets	"	335	425	417	434
Fodder roots	"	1,009	1,127	1,116	1,136
Other fodder crops	"	299	523	512	534
Vegetables, excluding potatoes .	"	277	427	430	498
Fruit	"	307	302	301	299
Bare fallow	"	423	280	240	231
Other crops not included above.	"	127	358	444	457
Temporary grass for hay and grazing	"	4,145	3,831	4,217	4,752
Permanent grass for hay and grazing	"	18,750	13,706	12,319	11,698
Rough grazings	"	16,476	16,959	17,117	17,172
Dairy cows	1,000 head	3,321	3,398	3,550	3,582
All other cattle and calves	"	5,551	5,677	5,709	5,964
Sheep	"	26,887	21,506	20,383	20,340
Sows for breeding	"	542	250	186	252
All other pigs	"	3,852	1,893	1,643	1,623
Chickens	"	69,580	53,502	46,371	50,301
Ducks, geese, and turkeys	"	4,827	4,312	4,357	4,904
CANADA					
Wheat	1,000 acres	25,595	21,587	16,850	23,284
Oats	"	13,247	13,782	15,407	14,315
Barley	"	4,291	6,973	8,397	7,291
All rye	"	816	1,338	576	648
Flaxseed	"	307	1,492	2,948	1,323
Maize for husking	"	172	358	230	270
Dry peas	"	85	90	102	84
Dry beans	"	68	80	85	100
Potatoes	"	516	506	533	535
Sugar beets	"	34	63	53	58
Tobacco	"	69	79	71	89
Hay and clover	"	8,766	9,707	9,816	10,320
Milk cows	1,000 head	3,884	3,680	3,795	3,930
Beef cows	"	603	580	703	827
Sheep and lambs	"	3,369	3,197	3,459	3,726
Pigs	"	3,888	7,125	8,148	7,738
Hens and chickens	"	55,020	68,106	74,960	86,792

TABLE 7.—CROP ACREAGE HARVESTED AND LIVESTOCK POPULATION ON FARMS^a
IN THE UNITED KINGDOM, CANADA, AND THE UNITED STATES, PREWAR YEARS,
1942, 1943, AND 1944 (*Concluded*)

Commodity	Unit	Prewar ^b	1942	1943	1944
UNITED STATES					
Wheat ...	1,000 acres	57,293	49,200	50,648	59,309
Rye ...	"	3,699	3,860	2,755	2,254
Rice ...	"	1,004	1,450	1,468	1,466
Maize ...	"	92,699	89,021	94,455	97,235
Oats ...	"	35,761	37,878	38,395	38,984
Barley ...	"	10,816	16,850	14,768	12,359
All sorghums (except syrup) ...	"	13,190	14,749	16,038	17,650
Soybeans (for beans) ...	"	3,042	10,008	10,684	10,502
Peanuts (grown alone) ...	"	2,173	4,388	5,094	4,012
Flaxseed ...	"	1,451	4,424	5,847	2,794
Broomcorn ...	"	317	230	244	380
Dry beans ...	"	1,702	1,922	2,404	2,057
Dry peas ...	"	223	494	795	695
Potatoes ...	"	3,033	2,706	3,331	2,910
Sweet potatoes ...	"	800	709	896	771
Sugar beets ...	"	828	954	548	561
Sugar cane (seed and sugar) ...	"	287	317	306	295
Cotton ...	"	27,788	22,602	21,652	20,098
Tobacco ...	"	1,647	1,377	1,452	1,712
Processing vegetables ...	"	1,383	1,968	1,926	1,938
Fresh vegetables ...	"	1,694	1,603	1,514	1,810
All tame hay ...	"	55,770	60,117	60,880	59,547
Milk cows ^c ...	1,000 head	23,548	25,167	25,663	25,984
Chickens raised ...	"	664,373	794,787	933,965	745,795
Broilers, commercial ...	"	69,687	205,345	251,649	223,000
Turkeys raised ...	"	27,006	33,110	32,970	36,397
Sows to farrow ...	"				
Spring ...	"	6,817	9,650	12,136	9,187
Fall ...	"	4,306	6,814	7,576	4,941
All cattle and calves ^d ...	"	66,814	75,162	79,114	82,364
Beef cattle and calves ^d ...	"	31,401	36,350	39,081	41,437
Sheep and lambs ^d ...	"	51,344	56,735	55,775	51,769
Pigs ^d ...	"	43,932	60,377	73,736	83,852

^a Livestock on farms : United Kingdom and Canada, as of June of each year ; United States, as indicated by footnotes.

^b Prewar years : United Kingdom, for crops, 1936-1938 and for livestock, June 1939; Canada, 1935-1939; United States, 1935-1939.

^c Average number on farms during year.

^d Number on farms on January 1.

II. COMPOSITION OF THE TECHNICAL COMMITTEE ON NUTRITION AND FOOD MANAGEMENT

1. In April 1944, Committee "C" of the United Nations Interim Commission on Food and Agriculture established among a number of other committees a Technical Committee on Nutrition and Food Management. The following have served as members of the Technical Committee:

Dr. F. G. Boudreau (U. S. A.), *Chairman*; Chairman, Food and Nutrition Board, National Research Council, Washington

A. N. Duckham (U. K.), *Rapporteur*; Director of Supply Plans Division, Ministry of Food, London

Charles S. Hanes (U. K.), Director of Food Investigation, Department of Scientific and Industrial Research, Ministry of Food, London

Ian McArthur (Canada), Acting Chief, Agricultural Statistics, Dominion Bureau of Statistics, Department of Trade and Commerce, Ottawa

Frank L. McDougall (Australia), Economic Adviser to the High Commissioner of Australia, London

André Mayer (France), Professor and Vice-President, College de France, Paris

L. A. Maynard (U. S. A.), Professor of Animal Nutrition, Cornell University, Ithaca

J. A. Scott Watson (U. K.), Professor of Rural Economy, Oxford University, Oxford

Henry C. Sherman (U. S. A.), Mitchill Professor of Chemistry, Columbia University, New York

Anna Speers (Canada), Executive Assistant, Department of National Health and Welfare, Ottawa

Hazel K. Stiebeling (U. S. A.), *Rapporteur*; Chief, Bureau of Human Nutrition and Home Economics, Department of Agriculture, Washington

F. V. Waugh (U. S. A.), Assistant Deputy Director, Office of Distribution, War Food Administration, Washington

Dr. Russell M. Wilder (U. S. A.), Mayo Foundation, Rochester

2. The following comprised the technical secretariat of the Committee:

Faith Clark (U. S. A.), Food Economist, Bureau of Human Nutrition and Home Economics, Department of Agriculture, Washington

Esther F. Phipard (U. S. A.), Food Economist, Bureau of Human Nutrition and Home Economics, Department of Agriculture, Washington

3. The following were consulted by the Committee at its first meeting on May 1, 1944 :

Andrew Cairns (UNRRA), Chief, Food Division, United Nations Relief and Rehabilitation Administration, Washington

Dr. Raymond Gautier (League of Nations), In charge of Health Section, League of Nations, Geneva

Dr. Robert S. Goodhart (U. S. A.), Chief, Industrial Feeding Programs Division, War Food Administration, Washington

... John Lindberg (League of Nations), Economic Section, League of Nations, Princeton
 Charles G. Woodbury (U. S. A.), Director, Raw Products Bureau, National Canners Association, Washington

III. SUPPORTING DOCUMENTATION

1. The following supplementary mimeographed reports were issued by the United Nations Interim Commission on Food and Agriculture. The classification numbers by which they are listed are the Committee's code numbers by which the documents are filed in the Registry of the Interim Commission.

DEVELOPMENTS IN FOOD PROCESSING AND DISTRIBUTION, by Frederick V. Waugh, Doc. 1, June 16, 1944, 8 pp.

POSTWAR APPLICATIONS OF WARTIME DEVELOPMENTS IN FOOD PROCESSING, by C. S. Hanes, Doc. 2, June 20, 1944, 7 pp.

FEEDING THE WORLD, by A. N. Duckham, Misc. 2, July 20, 1944, 3 pp.

WARTIME DEVELOPMENTS IN THE UNITED KINGDOM, Doc. 3, July 24, 1944, 22 pp.

WARTIME DEVELOPMENTS IN CANADA, Doc. 5, August 9, 1944, 12 pp.

WARTIME DEVELOPMENTS IN THE UNITED STATES, Doc. 9, August 16, 1944, 27 pp.

WARTIME FOOD MANAGEMENT IN THE UNITED KINGDOM, Reproduction of a manuscript prepared by the British Ministry of Food, Misc. 4, August 19, 1944, 39 pp.

WARTIME NUTRITIONAL MEASURES IN RELATION TO PRE-WAR DEFICIENCIES, Reproduction of a manuscript prepared by the British Ministry of Food, Misc. 5, August 19, 1944, 8 pp.

AGRICULTURAL MARKETING IN THE UNITED KINGDOM BEFORE AND DURING THE WAR, Reproduction of a manuscript prepared by the British Ministry of Food, Misc. 6, August 19, 1944, 59 pp.

WARTIME FOOD POLICY IN THE UNITED KINGDOM AND ITS NUTRITIONAL SIGNIFICANCE, Reproduction of a manuscript prepared by the British Ministry of Food, Misc. 7, August 19, 1944, 32 pp.

SOME WARTIME DEVELOPMENTS IN FOOD TECHNOLOGY IN THE UNITED KINGDOM, Reproduction of a manuscript prepared by the British Ministry of Food, Misc. 8, August 19, 1944, 21 pp.

CONSUMER SURVEY, Reproduction of a manuscript prepared by the British Ministry of Food, Misc. 9, August 19, 1944, 19 pp.

THE WARTIME CONTROL OF WHOLESALE AND RETAIL FOOD PRICES IN GREAT BRITAIN, Reproduction of a manuscript prepared by the British Ministry of Food, Misc. 10, August 19, 1944, 15 pp.

WARTIME LESSONS IN FOOD MANAGEMENT, PUBLIC RELATIONS AND FOOD ADVICE, Reproduction of a manuscript prepared by the British Ministry of Food, Misc. 11, August 19, 1944, 4 pp.

AUSTRALIAN ACTIVITIES IN THE FIELD OF HUMAN NUTRITION, by Dr. F. W. Clements, Misc. 14, March 30, 1945, 19 pp.

THE HEALTH OF THE NATIONS, Extract from a broadcast by Sir Wilson Jameson, Misc. 15, April 3, 1945, 3 pp.

AGRICULTURAL PRODCUTION

**Report of the Technical Committee,
on Agricultural Production, submit-
ted to the United Nations Interim
Commission on Food and Agriculture**

February 7, 1945

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INTRODUCTION AND GENERAL RECOMMENDATIONS

1. Victory in war is now assured for the United Nations. But victory in peace, which alone can make the sacrifices of the war worthwhile, still lies ahead. The Food and Agriculture Organization of the United Nations is being established to help in achieving this victory. It is charged with the task of aiding its Member nations to secure for their people adequate food and clothing, and to ensure for their farmers a full share in the increased well-being. Only to the extent that it, along with other international organizations, succeeds in helping the people of the world move forward to a richer, freer, and more secure life, will this union of nations have meaning.

2. In any survey of agricultural production problems the first outstanding characteristic is the wide disparity between conditions in different parts of the world. Modern science and technology have had an uneven application in human affairs. Less than one-third of the world's people live in countries where farmers make good use of modern scientific methods and machinery, where industry is highly developed, and where, though much progress still remains to be made, most of the population enjoys at least moderately adequate standards of food, clothing, and shelter. In these developed countries not more than two-fifths of the workers are farmers; the remainder are in industry, trade, and other non-agricultural employment.

3. The rest of the world's population lives in countries where farm production, except in a few specialized areas, is still carried on by traditional and primitive methods and where there is as yet little industrial development. Many of these countries are thinly settled, with large areas of land and other potential resources still available for development. On the other hand some areas, notably in India, China, the East Indies, and the Caribbean region, are densely populated. All these countries are predominantly rural; up to nine tenths of their population are farmers. Living is meager. Levels of output and of real income per person are generally only from one tenth to one fifth as much as in the developed countries. One of the great tasks of the future is to aid these less advanced countries to raise the producing power of their people and their living standards toward the levels already attained by the developed countries.

4. Expansion of world agricultural production has two principal aspects. First is the integration of agriculture with other sectors of the economic system. For increased production to be most useful, it must fit into an expanding and integrated world economy. Efforts to achieve this integration will help underdeveloped countries to the extent that they participate in world trade, but for the more developed countries, whose farmers are largely dependent on commercial agriculture, such integration is essential. International coordination of production programs would ensure that agriculture and industry keep pace with one another, that markets expand to absorb the increased output of food and fiber. Similarly, in each country, if the various sectors of economic

activity are to be kept in dynamic balance with one another and in harmony with expanding international trade, industry must expand in balance with agriculture, agriculture must expand each of its varied products in balance with consumer needs and desires, and the buying power of farmers and of workers in industry must expand in step with increasing productive capacity. Only so can continuing advances in methods of agricultural production and in industrial technology bring about corresponding increases in human well-being. FAO, in cooperation with other interested international agencies, will have an important role in helping Member countries to harmonize their programs of agricultural production and trade in pursuance of these ends.

5. The second aspect of agricultural production concerns technical measures for increasing output and efficiency. These measures, although of interest to all countries, will be of particular concern to the less developed ones. The three quarters of the world's farmers who live in these latter countries can greatly improve their lot as they learn to use modern farming methods. They could produce much more food with many fewer people. Industrialization is also needed to provide employment for surplus farm workers. As these less advanced countries increase their production both in agriculture and in industry they will have more products for their own consumption and more to exchange with other countries. In the years immediately ahead a large part of FAO's efforts to help countries improve their agriculture production methods must, therefore, be directed to these less advanced countries.

6. This assistance to the underdeveloped nations in helping them to raise their levels of production and of living will be of immeasurable benefit to all nations. The direct benefits to the countries so helped are obvious. Less apparent, but no less real, are the benefits to the developed nations. These benefits include larger markets for their goods, larger supplies of the raw materials they need, reduced economic stresses, and reduced political tensions. As living standards in the poorer countries rise toward the levels of their more advanced neighbors, competition from goods that are cheap because the living standards of the people producing them are low will lessen, and international trade will develop on a sound and mutually beneficial basis.

7. The work of the Food and Agriculture Organization will involve a world-wide attack on the problems of more production and more consumption. When the United Nations first approved the idea of an international food and agricultural organization at the Hot Springs Conference¹ they indicated in broad terms the functions they expected it to perform.² *The First Report to the Governments of the United Nations by the Interim Commission on Food and Agriculture* outlined these functions in greater detail. This present report goes a step further

¹The term "Hot Springs Conference" refers to the United Nations Conference on Food and Agriculture, which met at Hot Springs, Virginia, U. S. A., from May 18 to June 3, 1943. Its *Final Act and Section Reports* were printed by the U. S. Government Printing Office, 1943, as Publication 1948 of the Department of State Conference Series 52. (International documents are published concurrently by a number of the participating governments. Specific citations are given here to the documents as published by the U. S. Government.)

²See especially Resolutions XIV to XXII, inclusive, of the Hot Springs Conference.

by analyzing the problems with which individual countries and FAO will be concerned in the special field of agricultural production, and by recommending specific tasks which FAO might appropriately undertake to deal with them.¹

8. Many of the suggested measures involve governmental action affecting agriculture. Such action is not new. In the developed countries encouragement of scientific discovery and of increased efficiency in agricultural production have long been recognized fields of public concern and action. Two world wars have extended this public interest to all aspects of agriculture—to problems of economics and nutrition as well as of production.

9. In planning their future agricultural policies, nations can learn much from the mistakes and successes of their past efforts. During World War I nations were concerned chiefly with getting sufficient food and preventing price inflation. During the inter-war period producers and governments in the highly developed countries struggled with too much food for the existing markets. In neither period did use of food for optimum nutrition greatly affect the formulation of national agricultural policies. During World War II attention was again concentrated on getting enough food, but this time considerably more attention was paid to nutritional values and to fair distribution among consumers. Despite war scarcities, the level of nutrition actually rose in some of the warring countries. This promises well for greater success when the world's energies and resources can again be centered on the constructive tasks of peace.

Recommendations

10. Using the lessons of this past experience, and trying to envisage the difficulties of the years ahead, an attempt is made in the following pages to sketch the major problems in the field of agricultural production. Lines of work are suggested which might usefully be undertaken by Member nations, and specific recommendations are made as to the functions of FAO as an international agency. The Committee classifies these functions into three broad groups, as follows:

(1) Integration and coordination of agricultural programs.

As already indicated, this work will be of primary interest to the developed countries but will be of service to all. It involves (a) working with countries to collect the facts as to present and proposed agricultural production programs, (b) summarizing the facts in such a way that the interrelationships between the production programs of different countries are pointed up with special reference to plans for improved nutrition and to prospective deficiencies or excesses in the supplies of individual commodities, (c) discussing these summaries with all nations concerned, and then (d) advising countries in planning consequential readjustments in their production and trade programs. Included under this general heading are studies of agricultural reorientation problems, regular surveys of the world situation in each of the principal agricultural products, collaboration with agencies responsible for commodity arrangements, and advice to Member countries on making fullest use

¹The persons cooperating in the preparation of this report and the supporting documentation are listed in Appendix II.

of resources and manpower by integration of agricultural and industrial programs. Many of these activities and of those outlined in the next two paragraphs would involve cooperation with other international organizations, as well as with the countries concerned.

(2) **Improvement of agricultural production.** This work, although of major importance to the countries that have made the least progress in improving agricultural production, will be of assistance to all countries. FAO should become a world center for the collection of up-to-date information on agricultural science, and for the stimulation and coordination of further advances. It should organize panels of outstanding experts in various fields, and stand ready to send missions of experts to aid individual countries at their request. Special attention would be given to increasing the output of protective foods, particularly dairy and poultry products and fruits and vegetables. Studies would be conducted on the ways of dealing with particular problems in various countries, such as financing agricultural developmental projects, facilitating land programs involving soil conservation, drainage, irrigation, etc., or providing adequate fertilizer supplies. The results would be made available to all countries as an aid to their choice of methods. Similar services would be supplied in connection with the tenure and labor problems of farmers and agricultural workers, and with the related problems of cooperative organization and agricultural credit.

(3) **Improving education and extension services.** Agricultural advances, regardless of whether they involve the quantity or the methods of production, can be effective only as they become known to farmers and are put into use by them. Accordingly, one very important phase of FAO's work will be that of aiding countries to improve their educational and extension activities. This will be particularly valuable to less advanced countries where these activities have as yet had little attention. Functions carried on by FAO in developing education and extension would include giving guidance on ways of improving extension methods, and making available expert advice in the training of personnel, the education of youth, the development of related general and vocational education, and the selection of effective educational materials.

11. FAO would thus undertake a rounded program of work on agricultural production in cooperation both with governments of Member nations and with related international organizations. Worked out step by step, this program would help the people on the land who make up the mass of the world's population to live richer and fuller lives, and to contribute to and participate in that expanding economy the achievement of which is a major task of the United Nations.

PART I. BACKGROUND

1. THE INTER-WAR PERIOD

PRODUCTION

12. For the Western world at least the gloomy predictions of Malthus have not been fulfilled. World population has increased, but world food output has increased faster. The opening up of new lands and the application of scientific discoveries to farming have brought about a prodigious increase in agricultural output. For over two hundred years man has produced more and more food with each succeeding decade.

13. To this general trend the two inter-war decades were no exception. In the years 1935-1939 more food was produced than ever before in human history. But progress was not uniform in all countries. The substantial increase in total world agricultural production was due to large increases in the most developed countries and in exporting areas. Little or no increase took place in many underdeveloped countries. Food production, moreover, expanded least where population was growing most rapidly. In India, for example, population rose by 24 percent in twenty years while meat and rice production and cultivated acreage as a whole remained practically static. In a few areas, notably certain eastern European countries where land reform broke up large estates into family-type farms, food production actually declined for a time after World War I.

14. The most striking agricultural progress occurred in parts of North and South America, the British Dominions, northwestern and central Europe, and the Soviet Union. In the Americas and the Dominions production was stimulated by the abnormal demands of World War I. Canada greatly increased its wheat exports; Argentina, Australia, and New Zealand forged ahead with dairy products, and the United States with fruits and vegetables. Western and central Europe and the Soviet Union, in contrast, had first to recover from the setbacks of war, yet they, too, later attained new record levels of food output.

15. At the outbreak of World War II, in 1939, the application of science to agriculture was receiving increased attention in many countries. In biochemistry and genetics, for example, investigations were under way that held promise of discoveries more far-reaching than any yet witnessed. Agricultural extension services were becoming more effective in getting farmers to make practical application of known scientific facts. Agricultural programs involving direct governmental guidance were reinforcing extension work in such fields as soil conservation and farm management. Had the war not intervened, agricultural progress would have accelerated even more. Although food production in 1939 still was far from adequate to meet nutritional requirements, the more highly developed parts of the world were moving at increasing speed toward that goal.

TECHNOLOGY

16. Several factors made possible this inter-war expansion in agriculture. One was the cultivation of new lands. In the Soviet Union, and to a lesser extent in Argentina and Brazil, millions of acres of virgin land were brought into cultivation. The boundary of cropping was pushed farther north by the introduction of new cereal varieties and new vegetables in the northern areas of the Soviet Union and of new cereal varieties in Canada. In India and several Near Eastern countries, and in the arid regions of North America, hundreds of thousands of new acres were opened by irrigation. Italians drained the Pontine marshes and the Dutch began drainage of the Zuider Zee. Although some of these projects had more economic justification than others, taken together they made a substantial addition to the world's agricultural land, and more than offset the acres taken out of cultivation for the development of cities and communications. At the same time, the soil conservation program introduced in the United States saved large areas from going out of cultivation.

17. A second and more important factor was a general increase in yields per acre in many countries. This was brought about by a series of improvements in all phases of crop production. Hybrid corn, disease-resistant varieties of cereals, new grasses, and improved vegetables are notable examples of improvements in the field of plant breeding. New developments in the production and use of fungicides and insecticides reduced risks and losses, especially in fruit and vegetable growing. In addition, fertilizer consumption expanded enormously in the intensively farmed zones of northwestern Europe and eastern United States, and increased attention was paid to fertilizer placement in the soil. Generally speaking, however, such progress was mostly limited to the Western countries, for technical and social factors retarded development in the countries where the need for increased output was greatest.

18. A third factor was the increase in numbers and improvement in the productivity of livestock. Outstanding increases were achieved in Denmark and New Zealand. Pig numbers in Denmark rose from $2\frac{1}{2}$ millions in 1914 to $5\frac{1}{2}$ millions in 1931. In New Zealand the number of cattle increased from 2 to $4\frac{1}{4}$ millions between 1914 and 1939, and pig numbers likewise more than doubled. In these countries, and elsewhere, production records were becoming the established basis for breeding improved dairy cattle, and beginnings were made with the use of proved sires and artificial insemination. Extended knowledge of animal nutrition meant more effective rations not only for dairy cattle but also for beef cattle, pigs, poultry, and other classes of livestock. Continued research in animal diseases led to the introduction of many preventive and control measures, such as the use of tuberculin in eliminating tuberculous cattle and inoculation of calves against Bang's disease. Similar measures substantially reduced mortality among pigs and poultry. Altogether there was a material reduction in the losses from animal diseases and an improvement in efficiency of livestock as converters of feed into finished food products. These advances, too, were confined mainly to the Western world.

19. A fourth factor making for larger output of food was a great change in equipment of all kinds, including machinery on the farm, storage facilities at farm and market, and transportation to consuming

centers. Human or animal labor was progressively replaced by tractors, combine harvesters, hay-loaders, irrigation engines, corn-pickers, milking machines, power sprayers for fruit, and planting machines for vegetables. By doing the work more economically and by decreasing the acreage required for feed for draft animals, this mechanical power increased net food output per acre. Moreover the same hours of manpower produced vastly more food. Developments in rail and motor transport and the building of speedier ocean freighters brought producers closer to their markets. Improved refrigeration methods and the introduction of chilling and quick-freezing processes made possible the shipment of perishables from, to, and across all continents. As in the case of other technological factors that have served to increase food production, these mechanical innovations were adopted first in the more prosperous countries. There scarcity of labor and high wages encouraged the introduction of labor-saving devices, and consumer buying power was great enough to encourage more elaborate marketing equipment. In China or Central Africa, a transport of twenty miles still remained as difficult as a consignment from Los Angeles to Boston or from Buenos Aires to London.

20. Only a few of the salient developments have been mentioned. Even so, it is clearly evident that during the inter-war years man acquired a wide range of new and improved methods which made it possible to produce more and different kinds of food with appreciably less effort. This trend is still going on and will undoubtedly continue.

ECONOMIC POLICY

21. These technological developments might well have been expected to bring prosperity and better levels of living to the farm population of the Western world. For a time—in the early years of the inter-war period—they seemed to do so. In some industrial countries farm purchasing power did increase in step with that of non-farm workers. In some areas agriculture developed rapidly and specialization increased. During the latter half of the 1920's, however, expanded food supplies from the non-European exporting countries began to press on the restored production in Europe. This tended to intensify a wave of protectionist measures. The accumulating stocks of farm products in turn helped to precipitate a break in markets, and after the great depression began in 1929 farm prices and incomes fell disastrously in most countries. The recovery in industry and agriculture in the late 1930's partially restored pre-depression levels in some areas but it was not until the demands of World War II became effective that farm prosperity really returned.

22. The economic difficulties in agriculture had their origin in the early 1920's. Production in the major exporting countries, expanded to meet war demands when the output of European agriculture was seriously curtailed by World War I, remained at a high level after European farming recovered. These increased supplies might well have been used to raise levels of nutrition generally, but the major countries were not ready to develop international trade on a mutually helpful basis. The United States pushed exports vigorously, but raised its own tariffs to new high levels which restricted imports. War debts and reparation payments, complicated balance-of-payment problems for many European governments. Some sought to make their peoples more self-sufficient in case of another war and so curtailed imports

of food as well as other products. By 1925, France, Germany, and Italy were building up tariff walls. The countries of eastern Europe had begun even earlier. Stocks of rubber, wheat, cotton, sugar, coffee, and other staples began to accumulate in the exporting countries, and basic commodity prices began to decline, even before the world-wide financial crash of 1929.

23. Faced with the threat of imports dumped at salvage prices, every country strengthened its trade barriers. The United States raised its already high import duties. The United Kingdom abandoned free trade in agricultural products. Other European countries coupled exchange restriction with a network of quota controls, clearing agreements, and bilateral trading arrangements. India raised trade barriers against sugar from Java. Unemployment, part-time work, and wage reductions were general in industry. National finances were too precarious for anyone seriously to propose large-scale consumption subsidies as a remedy; in any case, the depression had already gone too far. Each country sought by import restrictions to "export unemployment," often thereby aggravating unemployment elsewhere. Exporting countries, in turn, were driven to measures to support farm prices, regulate exports, and restrict production internally, and in some cases agreements were reached to apply such measures internationally.

24. The surpluses of the exporting countries were virtually excluded from continental European markets and flowed mainly toward the United Kingdom. Each country competed against the others in export subsidies to hold a share in a shrinking world market. For years many products sold at less than cost of production. The British consumers, it is true, benefited and registered a striking increase in consumption of butter and eggs. But farmers in most countries were impoverished. Many lost hope in the possibility of a return of reasonable prices, but they continued to produce.

25. Although these developments have been summarized chiefly from the viewpoint of the principal exporting and importing countries, almost every country was affected. Near and Middle Eastern countries and tropical territories relying on agricultural exports to obtain foreign exchange found the buying power of their exports reduced by half or more. India and China were similarly affected but to a lesser extent. The Soviet Union, self-sufficing in food and vigorously carrying forward its own program of industrialization, was less affected than most other countries.

26. Industrial recovery from 1933 to 1939 was accelerated in Germany and later throughout Europe by large public expenditures in preparation for war. In North America recovery was stimulated by public expenditures for internal development, by agricultural programs, and by unemployment relief. The industrial recovery reduced unemployment and raised the incomes of farmers and city people somewhat from the low levels reached in the depths of the depression. International trade lagged behind this recovery in internal activity. Neither in the city nor on the farm, however, were producers as prosperous at the outbreak of the war as they could have been if recent technological advances had been effectively put into use, and if employment and consumption had been maintained at high levels. In addition, many of the agricultural policies followed were adopted without

regard to nutrition, and in some cases they actually worked against good nutrition and efficient production.

27. One common result that emerged out of the confusion was a far greater measure of government intervention in agricultural affairs. In importing countries governments sought to protect their farmers against "unfair" competition; in exporting countries they tried to keep farmers in business with subsidies. In both they sought directly or indirectly to influence the volume of production and to secure, in return for public assistance, improvements in farm efficiency; in both they were driven to some control over foreign trade. In the Netherlands, for instance, state-directed marketing schemes took control of all important agricultural products whether for home or for export markets. Prices were guaranteed for a controlled volume of production. The importation and exportation of agricultural products were completely controlled. This was but one variant of the many elaborate administrative programs evolved to deal with the intractable problem. Other far-reaching programs were developed in lands as far apart as the United States, Yugoslavia, Egypt, New Zealand, the United Kingdom, and the Netherlands East Indies. Public intervention in agriculture went much further than in industry, and in 1939 seemed to have come to stay.

28. Schemes for trade regulation, moreover, began to move from the national to the international level. International commodity arrangements were established or projected for rubber, tea, sugar, wheat, coffee, and cotton, as well as for less important commodities.

29. As one looks back over these twenty inter-war years, it becomes apparent that new problems had presented themselves and that their character was not generally understood. Nearly everyone associated the agricultural crisis with disturbances wrought by World War I, with political trends toward autarchy, and with the economic depression. Each of these undoubtedly played its part as an aggravating factor. But there were deeper and more permanent underlying difficulties; agricultural production tended to run persistently in excess of current effective demand; the mass of the population in the less developed countries remained in its chronic state of poverty and malnutrition; even in the most advanced industrial countries full employment was not provided for the workers.

30. Expanding efficiency in agriculture can be translated not only into more food but also into fewer workers in agriculture, with more workers released to industry to produce other commodities. The United States, for example, since the beginning of the nineteenth century has changed from an agricultural country, with 90 percent of its population in agriculture, to a highly industrialized country with only 23 percent of its population on farms. As the productivity of workers rises in agriculture and industry, the levels of living of workers can rise proportionately. But rising levels usually mean a greater expansion in the demand for industrial goods and services than in the demand for food, and so—except to the extent that a nation can advantageously increase its agricultural exports—rising farm efficiency must be accompanied by a reduction in the proportion of its workers engaged in food production. This general line of evolution in the developed countries indicates also the shifts that farmers and workers in the less advanced countries will face as improvements in methods, equipments, and skill

enable them to move forward to higher standards of production and living.

31. The measures taken during the inter-war period in the developed countries were not such as to facilitate a sufficient shift from agriculture to industry, or to maintain adequate buying power for the products the readjusted economies could have turned out. The presumed automatic adjustments in response to prices did not work out. Industry, hampered by monopolies, trade barriers, and other restrictive measures, did not expand jobs or workers' incomes fast enough to create enough new opportunities in industrial employment, and farmers did not shift out of farming in sufficient numbers. Governments, responsive to public opinion, could not allow "price squeezing" to operate ruthlessly on farmers. Instead, they intervened to support farm prices and to restrict output. With the developments in technology that were already available, the Western world needed fewer farmers and more workers in other occupations. The economic and political framework was not such as to bring about the necessary readjustments at a sufficiently rapid rate.

32. The nations might have based national food and agricultural policies in part at least on expansion of internal food consumption or of buying power for food. Instead, they concentrated most of their agricultural efforts on supporting prices received by farmers. To achieve this they attempted to restrict exports, imports, or production to what the existing markets would take at the supported prices. In some countries these restrictions resulted in throwing the diet still further out of nutritional balance. No government acting in isolation could provide effective remedies.

33. On the whole, the evidence suggests that agriculture had developed a capacity for production which could easily have provided much higher levels of consumption throughout the Western world than those actually provided. Opportunities were lost on both sides. There could have been more production and more consumption; perhaps with conscious effort the two could have been brought into balance. As it was, all governments provided only palliatives.

34. It is clear from this prewar experience that many of the difficulties of the inter-war years were caused by underlying forces which may reappear after the end of this war. If governments are to increase the efficiency of production and the levels of food output as was proposed at the Hot Springs Conference, they must not only take direct measures to stimulate consumption, but they must also take strong measures to keep industry expanding in balance with agriculture. Production and consumption cannot be expected to keep themselves in balance automatically. An expanding economy, which means more and better food and more and better industrial products and services, is within reach. But, if the inter-war experience is a reliable guide, its realization will require wise planning and foresight, and strong, positive measures by governments working in collaboration.

2. IMPACT OF THE WAR

VOLUME OF PRODUCTION

35. World War II greatly modified previous agricultural trends. In most belligerent countries there were marked shifts but their char-

acter was not uniform. In the large areas occupied by the Germans and the Japanese, the output declined materially and there was a major alteration in its composition. By contrast, in the United Kingdom, North America, and unoccupied parts of the Soviet Union, production was greatly expanded.

36. In Europe, the dislocation of farming was widespread. Not only were battle zones wider than in the last war, at one time overrunning 40 percent of the prewar cultivated acreage in the case of the Soviet Union, but Nazi occupation of some fifteen countries brought all their agricultures into the hard service of the German Reich and exposed them to the effects of the Allied blockade. Labor was moved ruthlessly from place to place. Fertilizer and fuel supplies declined, much machinery could not be repaired, or replaced, imports of concentrated feedstuffs disappeared, and much food was diverted to German consumption. The acreage under crops fell, as did the yield per acre. Land was shifted out of feed crops into potatoes, vegetables, and other crops for direct human consumption. Livestock numbers, especially pig and poultry, were reduced, and milk yields declined. In the worst areas—those most severely affected by combat or subject to the greatest terrorism, such as Poland and Greece—total agricultural output may have fallen by half. Moreover, the flooding with salt water of coastal areas in the Low Countries may reduce their productive ability for a number of years. For Europe as a whole, crop output was up slightly, and production of livestock products down about one quarter, with total food output down about one tenth.

37. Expansion of production was marked in the United Kingdom, Canada, the United States, and the unoccupied parts of the Soviet Union. Although labor, machinery, and fertilizers were scarce, it was possible to increase the productivity of available labor and put recent advances in plant and animal breeding into action quickly. The Soviet Union increased the intensity of labor applied in farming, applied many new techniques in plant and animal production, and brought new land into cultivation. The United Kingdom plowed up grassland and greatly increased production of potatoes, grains, and other products for direct human consumption. Canada and the United States, aided in part by favorable weather, sharply expanded meat and milk production and the production of food and feed crops, especially oilseeds.

38. Elsewhere in the world changes in volume of production were less considerable. In Japan and areas under Japanese occupation, shifts were made corresponding to those in Axis Europe but less marked in degree. In Java, for example, sugar output was cut down and cotton acreage increased. In Australia and New Zealand shortages of shipping, labor, machinery and fertilizers caused a small decline in production. The same was true of Argentina and some other South American countries. Wartime shortages also made it difficult for Middle Eastern countries to meet the increased requirements due to war conditions. Farming in India and China was only moderately affected, except in the war-scourged districts. For the world as a whole, increases in food production in some regions during the war about balanced reductions elsewhere.

SHIFTS IN COMMODITIES

39. War conditions necessarily forced agricultural production out

of its normal pattern in many countries. In Europe, as already indicated, the shifts were in the direction of greater self-sufficiency. Egypt transferred acreage from cotton to cereals. In North America, the United States and Canada expanded oilseed production to replace lost supplies from the Far East, and stepped up pig products sharply for the enlarged home market, the armed forces, and export. Cuba expanded sugar output to replace in part the supplies cut off by enemy occupation of the Philippines and Java. Also greatly increased were industrial substitutes for agricultural products such as synthetic instead of natural rubber, and rayon and other synthetic fibers in place of cotton and wool. The production of synthetic rubber in the United States alone in 1944 was almost as great as the prewar peacetime consumption of natural rubber by the whole world, and there was large synthetic production in Germany and the Soviet Union.

40. Careful consideration will have to be given to the extent to which such wartime changes should be continued in peacetime, but some of the wartime expansion in farm production may prove lasting. Production of poultry products, meat, vegetables, and soybeans was greatly expanded in North America, while vegetable growing was increased in Europe. These increased supplies of protective foods may well find excellent nutritive use in the postwar world. On the other hand, many countries will emerge with production patterns quite out of line with postwar needs and will face difficult problems of reorientation. Should European output of artificial fibers continue at 1944 levels after the war, for instance, requirements for cotton and wool in Europe—formerly the largest import market in the world—might be greatly reduced. The extent of peacetime use of these synthetic products will depend on economic and other factors which require careful study.

FARMERS AND GOVERNMENTS

41. War always brings temporary prosperity to some, and farmers usually have a share of it. World War II has been no exception. In some areas the cash gains have been illusory. They represented liquidation of livestock herds or they were reckoned in inflated, almost worthless currencies. In severely fought-over areas, or those ravaged by the Axis, farmers lost a large part of all their livestock and other capital. In many countries increased taxes absorbed much of the profits. But to some extent, farmers' gains were real. In many countries farmers' debts were reduced, and a reserve was laid by against a rainy day.

42. Along with this uneasy prosperity, the war brought to farmers all over the world a far greater degree of state control. Before the war this tendency had begun to spread as a safeguard against economic chaos and maladjustments in production. During the war it was used to encourage production and to regulate prices and marketings. The mildest form of intervention was the establishment of production goals for individual products divided into assignments to states, provinces, and counties. Some of the most drastic controls were those practiced in Germany and in some German-occupied countries, for example, the Netherlands and Czechoslovakia, where, for every separate farm a statistical record was kept, cropping acreages and livestock numbers were prescribed, and surrendered quotas for all products were established and enforced. This rigid regimentation continued through every stage of processing and marketing until the commodity reached the consumer as part of his ration. Even in certain neutral countries, in Switzerland for instance, controls were extremely far-reaching.

43. The stress of food shortages also impelled many governments to extend greatly their advisory and extension services and their intervention in agriculture in order to ensure the more efficient utilization of all agricultural resources. Novel methods were tried. In the United Kingdom, for instance, execution of production programs and improvement of farming operations of less efficient farmers were the responsibility of committees of the farmers themselves. This approach proved to be highly successful. Farms ineffectively tilled were taken over and operated by other farmers or by the committees.

44. In almost all belligerent countries, farm labor was economized and output per man was strikingly increased. The methods employed were various. Expansions in output were achieved with virtually no addition to the regular agricultural labor force, and in some instances with a decline. The labor of women and children was called on to replace that of men who were drawn off to armies and factories; school children, youth, and city people were organized in volunteer labor groups to help with the harvests. In some cases more machinery was used. Tractor numbers in the United Kingdom, for instance, were raised from 50,000 to 150,000. In some cases, considerably larger quantities of fertilizers were applied. Much of the larger output, however, resulted from the increased physical efforts and longer working hours of the farmers and their workers. Though this overworking of farm people should not continue after the war, many of the innovations represent real economies which certainly will be retained. They constitute a permanent advance in the efficiency of farming.

3. POSTWAR PROSPECTS

PRODUCTION AND MARKETS

45. Between the writing of this document and its publication many occupied countries will have been liberated. What is now tentative forecast may then be ascertainable fact. Some areas are being ruthlessly laid waste by the retreating enemy; others are being freed with little damage. As regards farm crops, whether in Europe or the Pacific, much will depend on the season at which liberation will occur. Recently harvested crops can easily be destroyed. Likewise extensive fighting during the sowing season may seriously reduce the next harvest.

46. The immediate problems after liberation involve relief and the first steps toward rehabilitation. There will be an urgent need for food in many countries, especially for fats and high-protein livestock products. Essential materials for agricultural production must also be supplied. The principal shortages anticipated by the United Nations Relief and Rehabilitation Administration are those in seeds, fertilizers, veterinary supplies, feedingstuffs, fungicides, insecticides, draft power, and machinery.

47. Even with effective measures to provide materials and assistance from other countries, it may be two, three, or even four years before normal levels of food and feed production are regained in all countries. Pig and poultry numbers could probably be restored in two or three years if feed were available. It took nearly a decade after the last war, however, to restore continental livestock production. Cattle numbers in countries such as Belgium, the Netherlands, and Greece may not be able to recover fully in less than six to eight years. Recovery is likely to be attained at different dates for different products. More-

over, it must not be assumed that each nation will wish to return exactly to its prewar pattern.

48. In the areas where production has been pushed to high levels—the Soviet Union, the United Kingdom, and North America—efforts will be made to keep it high. Already, stocks of wheat have reached unprecedented levels. In South America, Australia, and New Zealand expansion in grain and livestock production will be called for as soon as shipping becomes available. The scope for expansion in some territories is considerable, especially when more labor is available and machinery and fertilizers can again be purchased.

49. In the less developed agricultural regions of the world chief attention is likely to be devoted to improvement schemes, though many of these territories will retain a lively interest in the markets for the special products that form a large part of their export trade—such products, for example, as natural rubber, tropical oils, silk, dates, and jute.

50. Altogether, it seems probable that agricultural production, particularly food production will rise in a very few years after the war to a new record high level. There will be recovery in Europe, some expansion in the Southern Hemisphere, some retention of wartime increases in certain nutritionally desirable commodities in North America and the United Kingdom, and efforts to establish increased output in previously underdeveloped regions.

51. At a much earlier date the world may be faced with embarrassingly heavy stocks of certain raw materials, especially cotton and wool. Even if the current enormous stocks of these commodities can be disposed of smoothly, the competition from synthetic substitutes may constitute a continuing problem. Demands for these industrial raw materials, however, are very elastic with respect to income changes. Establishment of materially higher levels of world income would greatly increase demand levels for textiles and rubber, perhaps enough to absorb both natural and synthetic production.

AGRICULTURAL POLICIES

52. Under such circumstances as these, what agricultural policies are governments likely to adopt? Few governments are yet in a position to formulate long-term policies in any concrete terms. Nevertheless, there are already certain commitments. The United States Government, for example, has undertaken to maintain farm prices for a number of products for at least two years after the end of hostilities. The United Kingdom Government likewise is committed to a definite program covering production and prices of certain products which carries through 1948, and in addition has concluded certain long-term contracts with overseas suppliers. Canada recently established a board with fairly general authority to support agricultural prices in the postwar transition period, and created other agencies to aid farmers in postwar farm improvements, housing, and farm living. In these countries the intention is clear to make the transition from war to peace as smooth as possible. Other countries also may have continuing commitments to their farmers.

53. As a result of experience during the war years, it seems certain that agricultural policies in many countries will include larger and

more effective expenditures on agricultural research and extension. It is to be expected that such action would continue the recent rapid progress in agricultural efficiency and output in the leading food-producing countries. In the less developed countries it would make a start toward meeting more adequately their nutritional requirements. Such continuing technological progress will increase the importance of finding ways to expand demands in proportion to rising food supplies.

54. In some instances, postwar policies are being discussed jointly by several neighboring countries. The Middle East Agricultural Council is formulating plans to deal with the urgent needs of that region. The Caribbean Research Council is investigating means for increasing local food production with the aim both of diversifying farming and of raising nutritional levels. The Inter-American Development Commission is evolving agricultural programs along with its other projects.

55. There is no doubt that many governments will concern themselves to a greater extent than before with the living standards of their farmers. The demand for some guarantee of stability is strongly voiced by farmers' organizations and by political parties that have rural interests. All this has important bearing on the principles laid down at Hot Springs, since there is a clear implication that in many countries the agricultural reorientation called for will have to be accomplished by government action within the framework of the nations' agricultural policies rather than through the free operation of market forces.

FOOD POLICIES

56. The war has shown that even in the best-fed countries in the world food consumption expanded materially as soon as there were full employment and adequate purchasing power. It has shown that even in some warring countries with a short total food supply, measures which were not particularly costly could be taken to raise dietary standards of the lower income groups above peacetime levels. As postwar measures they are well within the financial resources of most countries of the Western world, though for the less developed tropical and eastern countries a different approach may be necessary.

57. Farmers are being told today that the world needs food, that it can consume all they are producing and more. But they have a right to ask whether it will want all the food they will be producing under peacetime conditions. The formulation of schemes for larger and more efficient production is a comparatively easy technical task. To execute such schemes, however, might be of little practical value, might even be regarded as a mistake, unless there are genuine prospects that the additional food will be wanted.

58. It should be possible for many countries to achieve in peace the same kind of improvements in nutrition that some countries have attained in war. Farmers, moreover, have a right to expect that just as they progressively translate modern science into agricultural practice, so also the nutritional findings of modern science

should be translated into the food consumption habits of the people.¹

59. The formulation of food consumption policies, then, might be based on two central features: (1) measures aimed at establishing long-term full employment with its concomitant high level of purchasing power, and (2) special provision on a generous scale of protective foods for vulnerable and low income-groups. These conditions cannot of course be completely fulfilled immediately, but it should be regarded as a token of each nation's intentions toward FAO that it report steady progress toward these goals.

60. The problem of giving practical effect to nutrition policies will be much greater in the less advanced countries than in the developed ones. In China and India, for example, the overwhelming proportion of the population has incomes too low for adequate diets. The situation is similar throughout most of the underdeveloped regions of the world. In those countries resources are not available to subsidize consumption for so high a proportion of their population. Increased purchasing power of the masses can come only with an increase in their productivity, and with larger and better distributed incomes. Industrial development is essential for such increased production and incomes.

61. These countries, moreover, cannot buy large quantities of food, however cheap, on the world market while they have so little to offer in exchange. What exports they do have they may prefer to exchange for equipment to build their much-needed industries and communications. Hence it would be unwise for food-exporting countries to look upon such countries as an immediate large-scale market. Although many eastern peoples may be undernourished, their need for more food cannot become effective in international markets until they can produce goods to offer in exchange. This will take time, but they can make substantial improvements in nutritional levels at an earlier date by development of their own agriculture. International co-operation can greatly facilitate progress in the solution of such problems. In addition, it was pointed out at Hot Springs² that international arrangements might be extended to provide undernourished peoples with some of the food from exporting nations at special prices. This possibility is discussed further in connection with reorientation of agriculture.

62. As is recognized in the preamble to its Constitution,³ FAO will be concerned with the prosperity of farmers just as much as with the welfare of consumers. Freedom from want means little unless it also means freedom from want for farm families, unless it means radically better food, shelter, and clothing than most of them have had hitherto. It would be a perversion of the aims of the United Nations if, while full employment and rising living standards were achieved for industrial workers, farmers' earnings remained little above a subsistence level. Yet there is a real reason to believe that even if consumption levels are raised, the inter-war maladjustments between supply and

¹Hot Springs Resolution XXVII.

²See *Nutrition and Food Management—Report of the Technical Committee on Nutrition and Food Management*, and Hot Springs Resolution XVIII.

³United Nations Interim Commission on Food and Agriculture, *First Report to the Governments of the United Nations by the Interim Commission on Food and Agriculture*, Washington, August 1, 1944, p. 41.

demand may reappear after a time unless other steps are taken to keep supply and demand in balance. For the sake of farmers and of the world such a repetition must be avoided. Steps to deal with this problem are indicated in paragraphs 167 to 172. The object is mentioned here, because the many recommendations made subsequently for increasing world agricultural production could not be made in good faith, unless it were clearly understood in advance that arrangements for deliberately relating that production to consumers' current demands were also contemplated.

63. The fact that adjustments appear to be necessary makes it all the more imperative that those adjustments should be made to a steadily rising food demand stimulated by vigorous nutrition policies. As long as any avoidable undernourishment exists anywhere, there should be no reason for restricting total output ; what is surely wanted is more food. As the recommendations of Hot Springs are put into effect, and expanding consumption is accelerated, the case may eventually become different. Adjustment to underconsumption is restrictionism ; adjustment of production to adequate consumption is commonsense.

PART II. AGRICULTURAL PRODUCTION PROGRAMS

1. SHORT-TERM PROGRAMS

PROBLEMS OF REHABILITATION AND RECONSTRUCTION

64. The paramount task of the short-term period will be to get agriculture into working order again in the war-torn countries. The initial international responsibility for assisting governments in this task rests upon the United Nations Relief and Rehabilitation Administration, and plans are already being worked out for supplying these countries with necessary food, seeds, insecticides, machinery, draft animals, fertilizers, feedstuffs, and so on.

FOOD SUPPLIES

65. This is a period that will begin with acute shortages of many foods but one which may end with embarrassing surpluses. At one time it was feared that at the end of hostilities there would be a world shortage even of bread grain so that production of crops for direct human consumption would have to be maintained or increased for a time, and rebuilding of livestock herds would have to be deferred. Resolutions to this effect were adopted at Hot Springs¹ and at the first Council meeting of the United Nations Relief and Rehabilitation Administration at Atlantic City.² Subsequent crop developments have made it seem possible that grains may be in more abundant supply and restoration of livestock production may be started at an earlier date than was first anticipated. The conditions prevailing in each region at the end of hostilities will naturally determine the best course to be followed in providing relief and rehabilitation and in beginning reconstruction.

POPULATION MOVEMENTS

66. There is also the task of caring for, and eventually repatriating or resettling, not only millions of war refugees, but also many other persons who may be uprooted and resettled in the process of peace settlements, frontier changes, and resulting population transfers. Hundreds of thousands of farm families will be involved in these postwar population movements, both in Europe and in Asia.

67. In order that farming may not be made a dumping ground for unemployed and homeless people in areas where they will not have an opportunity for reasonable success, FAO will need to keep in touch with the agricultural aspects of such moves. Through close collaboration with the United Nations Relief and Rehabilitation Administration, FAO should help governments to see that persons settled in

¹Hot Springs Resolutions XII and XIII.

²United Nations Relief and Rehabilitation Administration, *First Session of the Council of the...* Washington, 1944, Resolution No. 11, Sections 1 and 2.

agricultural areas fit in as well as possible with long-range agricultural opportunities and policies.¹

IMMEDIATE OPENINGS FOR TECHNICAL IMPROVEMENTS

68. At the same time that the process of resettlement and rehabilitation is taking place, many less advanced countries will wish to take immediate steps to improve the living standards of their people. This will be particularly true of those countries where industrialization and other measures for basic progress will be necessarily long term and slow to produce any immediate effect upon the living conditions of most of the people.

69. Under such conditions relatively simple and inexpensive things can be done to bring about a quick and marked improvement in food production. Use of some of the insecticides to control long-tolerated pests, the addition of phosphorus to livestock foods, and the development of poultry keeping with improved methods of feeding are examples. In many such cases agricultural authorities in the countries concerned undoubtedly are aware of the problems and frequently are aware of the possibilities of overcoming them, and such steps could be speeded by additional information and facilities provided by the international body.

Recommendations

70. With regard to liberated areas the United Nations Relief and Rehabilitation Administration is already obtaining certain information from governments. By the very nature of agriculture, even immediate relief operations, such as crop sowing, have long-term consequences. Therefore, the Committee considers that :

(1) It is necessary for FAO to keep closely informed of the activities of the United Nations Relief and Rehabilitation Administration, and of their relation to longer term programs, covering both agricultural production programs and resettlement operations in agricultural areas. Care will also be needed to provide an orderly shift in due course of such of the United Nations Relief and Rehabilitation Administration's agricultural activities as should be continued by FAO.

(2) In countries less affected by the war and in those outside the scope of the United Nations Relief and Rehabilitation Administration, the study of pressing problems can begin immediately. FAO should prepare itself as promptly as possible to furnish information and advice to such countries. In particular, it should give special attention, in its short-term program, to seeking out opportunities for immediate technical improvements such as those outlined in paragraph 69, and encouraging governments to take steps to put them into use by their farmers. Illustrations of some projects which offer such prompt returns are given at the end of this report.²

(3) At the same time FAO should begin collating and analyzing the short-term production programs of all Member

¹Hot Springs Resolution XXII.

²Appendix I.

governments and the long-term programs as they are formulated, and should indicate the extent to which they fit into a consistent world pattern and implement the objectives laid down at Hot Springs.

2. CONTINUING PROGRAMS

71. Little can be done to raise the efficiency of agricultural production without means to assist and encourage farmers to put scientific knowledge and agricultural programs into practice. In the following pages the steps necessary for more effective education and extension are therefore considered first, followed in turn by measures dealing with the productivity of land and labor, the production of protective foods, other problems affecting agricultural production, general economic development, and reorientation of agriculture.

72. No attempt is made to state the principal agricultural problems of each individual country. The purpose is rather to explore the opportunities for international collaboration and to indicate projects to which FAO should give early attention.

EDUCATION AND EXTENSION SERVICES

73. Scientific discoveries cannot raise farm production standards until they are put into use by farmers. Better general education and more and better extension work are therefore key elements in programs for better agriculture. They are in special need of attention in many countries, particularly the less developed ones. For these reasons this subject deserves careful consideration.

74. During the past half century several countries have developed successful systems of agricultural education and extension.¹ The work done has given very tangible results in raising the general level of farming in those countries. A serious gap still remains, however, between the knowledge of the scientist and the practice of farmers.²

75. Experience with agricultural "action" programs in the late 1930's and production programs during the war suggests the possibility of new methods of approach to increase the effectiveness of extension services and shorten the time lag between scientific discovery and practical application. Devices such as farm production goals, soil conservation programs, plans for individual farms, benefit payments, marketing and price-supporting schemes, individual records of farm performance, or supervised credit to carry through defined production programs, have enabled direct contact to be established with large numbers of farmers who previously had not benefited from extension work. The experience in extension work to date in many countries has led to several conclusions as to what is needed to make such work most effective:

- (1) It is easier for educational workers to reach and influence large commercial farmers or large landowners than to reach small

¹"Extension" is the term used to indicate the process of carrying the results of scientific work to the farmers and getting them to put the improved practices into use. It is known by other names in various countries, such as "advisory work" or "agricultural service."

²Hot Springs Resolution XIX.

operators. Special efforts must be made, and perhaps special techniques will have to be employed, if the great mass of common men—small-scale farmers, peasants, peons, or sharecroppers—are to be helped, equally with the large operators, to improve their methods and position. Extension workers who are to be successful in such efforts must have a background of experience and knowledge of the traditions in order that they may have real sympathy with, and understanding of, the way of life and the problems of small-scale farmers, as well as the training necessary to help them in dealing with those problems.

(2) It is difficult to teach advanced technical methods to people who cannot read or write. General educational efforts with both adults and children to raise the group, at least to the point where it can read, write, and perform simple computations, are therefore an essential complement to agricultural extension work. Meanwhile, extension workers among these people must use ways of imparting information which the farmers can grasp and follow, such as pictures and simple demonstrations.

(3) Extension efforts lose effectiveness if educational or advisory services are submerged by supervisory or administrative functions. Administrative responsibilities not inherent in the extension work itself should be lodged in a separate organization with separate personnel, although extension efforts should explain the need for and functions of the administrative agencies and should cooperate closely with them.

(4) As far as possible, extension workers should utilize voluntary local leaders and other unpaid members of local groups; should secure the cooperation of local leaders, improve their understanding of agricultural problems, and then utilize these leaders to help reach the larger local audience.

(5) Extension workers should work through existing local groups, using them as agencies to spread educational messages, including schools religious groups, farmers' and cooperative organizations, and cultural groups. Extension workers should encourage and stimulate the development of more such groups wherever they are needed. Unless extension workers have a strong sense of social responsibility, they will lack the enthusiasm and belief in themselves necessary to get others to believe in the advice they have to offer.

76. There is need of education for nonagricultural pursuits. As has been emphasized, programs of industrialization will require the shifting of large numbers of workers from agriculture to industry, and this will involve deliberate training for the new occupations. Although this matter is not of concern exclusively to farmers, provision of adequate training facilities for industrial occupations would contribute to a more desirable mobility of farm labor especially in areas where there is rural overcrowding.

77. Extension work can do much to improve the contribution of the home to living standards, including food preparation and preservation, care of clothing, and home management in general. The wise utilization of what is produced, and the care in the selection, preparation, and conservation of food so as to secure best nutritive results,

have a crucial importance in the nutrition of the family. These aspects of extension, frequently grouped under "home economics," are as important in raising farm standards of nutrition and life as activities directed toward the production of crops and livestock. Extension work in home economics can usefully be directed to city as well as farm families.

78. Extension work must give attention not only to direct production, but also to the amenities of rural living. Efficiency in agriculture may be influenced directly by such factors as housing, the supply of water and electricity, health services, and roads and transport, all of which affect the well-being of farmers and farm workers. Farmers in most regions are less well provided with such services than are urban workers. This is the case even in some of the most advanced countries, although recently some progress has been made through such special measures as the Farm Security medical care program in the United States and the general health and medical care programs and clinics in the Soviet Union. Every country would find it profitable to attend to these aspects of rural life and make greater efforts to reduce disabilities. Programs of agricultural improvement have sometimes failed because the workers were suffering from infectious or deficiency diseases. Programs of agricultural development must deal not only with the technological and educational problems of agriculture, but with all the environmental factors that influence the health, working ability, and welfare of the people.

79. More and better extension work can be made possible only if most countries have more professional workers and if these workers are better trained than in the past. The necessary professional training can be provided in part by creating or expanding training institutions in each country and in part by arranging to send workers to study in other countries. In the past, study in other countries has often been of a haphazard nature, and the fields of study have frequently been influenced more by the regular courses of study at the foreign institution than by the needs at home. Students may thus return to their own country highly trained in certain directions yet little better prepared than before to deal with the most important problems that face them. Training abroad likewise may be either in basic or in applied science. In the case of basic studies, training abroad would seem to presuppose at least some understanding of their own agriculture and its problems, so that in addition to the basic training in science students receive abroad they can relate its application to their own country. The more advanced student, in addition to the training he receives in the basic sciences either at home or abroad, should have a sound and intimate knowledge of his country's agriculture and of the problems in the particular field of study that he proposes to pursue. He can then return to his country trained and qualified to deal there with problems of urgent importance.

Recommendations

80. The Committee recommends that FAO should:

(1) **Summarize and distribute educational information.** To collect and transmit to governments the latest and best educational pamphlets, manuals, charts, posters, and films on improved production practices and methods would be an essential function of FAO. This would apply particularly

to materials of general applicability in many countries, such as materials on livestock feeding; disease and pest control; soil and water management and control; land reclamation; vegetable production; plant nutrition; farm machinery and buildings, water, and electricity; and reports on economic outlook and adjustment. Such documents would provide governments with examples of materials of immediate application for extension and advisory services to use in increasing the volume of efficiency of agricultural production, in addition to what can be made available from their own research programs.

(2) **Encourage adoption of improved extension methods.** FAO could aid countries in the development of better advisory methods by conducting, in cooperation with the various governments, a quick comparative survey of the extension methods now in use, and of their relative effectiveness under varying national conditions in securing the ends sought. On the basis of these results, governments could be advised in developing the most effective methods for their own conditions.

(3) **Encourage adequate training of personnel.** Carrying the agricultural programs into action will require a great many more trained workers, both for scientific research and for extension. In many countries, especially the underdeveloped ones, shortage of trained personnel is a main handicap to adequate extension work. FAO might well conduct, in cooperation with governments, an immediate survey to ascertain the number of trained persons available in each country in the several fields, the number of students receiving training, and the institutions capable of providing such training. On the basis of the results of this survey it might then consult with governments as to ways in which they could train the personnel needed, including study in other countries, expansion of national training institutions, and possibly regional training programs. (For example, several Spanish or Arabic-speaking countries might cooperate to establish a regional institution to train agricultural and veterinary technicians for these purposes.)

(4) **Encourage education of youth.** Special attention should be paid to methods of providing agricultural and vocational education to farm youth, including, besides formal schooling, such techniques as the Danish Folk High Schools, the American 4-H Clubs, and the British Young Farmers' Clubs. FAO might survey such methods, provide expert advisers where requested, and help make arrangements for leaders in one country to take training courses in others.

(5) **Further general and vocational education and rural welfare.** In collaboration with other appropriate international agencies, FAO should encourage governments to see that both general and vocational education among farm people are broad enough to meet widening industrial possibilities as well as new agricultural ones.

In the wider fields of rural welfare, housing, health services, and so on, FAO should consult not only with government representatives and interested international agencies, but also

with a wide range of organizations, cooperative societies and unions, farmers' organizations, farm workers' unions, chambers of agriculture, agricultural academies, women's societies, rural community councils, and many others. By energetically developing contact with these various bodies FAO could greatly enrich and strengthen its contribution to the cause of rural welfare.

TECHNICAL MEASURES FOR INCREASING PRODUCTIVITY

SOILS

81. In recent years nations have come to realize that over large areas of the world soil is being blown or washed away and the eroded lands rendered useless for cultivation.¹ The dust bowls of North America are only one example. Erosion is occurring on an alarming scale over vast areas of China and in important parts of Africa, Australia, and several Middle Eastern countries.

82. As a consequence, soil conservation is a leading feature in the postwar agricultural programs of many countries. As it is a problem requiring the application of special techniques fitted to the special circumstances, experienced experts from one country can be very helpful in advising on the problems of another. This is a field in which agricultural and forestry experts need to work together, for the careless slaughter of forests can start erosion on a large scale, whereas the planting of trees can often be a preventive or a cure.

WATER MANAGEMENT AND LAND RECLAMATION

83. It is not enough merely to hold down the land; the land must also be made productive. Here the outstanding problems are associated with water. Apart from favored areas in the North Temperate Zone nearly every country has large areas of land that are unproductive for lack of moisture; at the same time it has rivers down which millions of tons of water rush every year doing no good and often wreaking great havoc. In some countries measures for flood control, water distribution, and land irrigation have been in use for centuries. In others, as in many of the older civilizations of the Near and Middle East and of Central and South America, ancient irrigation works have long been abandoned, and once fertile areas now lie uncultivated and barren. Opportunities for irrigation, moreover, are great in many of the areas of rural overpopulation, for example, in large parts of central and western China. In addition, certain regions in Africa, in the Near and Middle East, and in South America could carry larger populations if the lands were watered.²

84. In other regions of the world the major problem is not to supply water but to get rid of it. Along the banks of many rivers and particularly near their mouths, large areas of swamp and marshland could be reclaimed and should be improved by drainage. Draining these lands would have two important advantages. It would provide more land for cultivation on soils which in most cases are extremely fertile. It would also contribute to health improvement by destroying the breeding grounds of mosquitoes and other disease-carrying insects. Again there

¹Hot Springs Resolution XX.

²Hot Springs Resolution XXI.

is much experience that can be drawn upon. In the Netherlands and Egypt, for example, drainage methods have reached a high degree of efficiency. From these countries as well as from others, experts might be made available for periods of service in countries that wish to create land drainage systems of their own.

85. The related problem of control of floods is exceedingly grave in many parts of the world. Large areas in great river valleys, such as those of the Yellow River and the Mississippi River, are subject to recurring loss from devastating floods. Methods of controlling such floods involve in part engineering works on channels, dikes and dams, and in part cultural and conservation measures to hold the water upstream. Methods of preventing or controlling such floods have been highly developed in Egypt and the United States. Methods of catching rain water in dams or cisterns for later use have been extensively developed in some countries. The experience and the experts of these countries could do much to aid other countries faced with similar problems.

Recommendation

86. The Committee recommends that :

FAO, in cooperation with governments, should make comparative studies of the legal and administrative arrangements which various countries have developed to facilitate progress in the fields of soil conservation, land drainage, and irrigation. Through such studies FAO could make available to other countries wishing to start similar action helpful and effective suggestions as to methods.

MAINTENANCE AND RESTORATION OF PRODUCTIVITY

87. Finally there is the problem of keeping soils at a sustained level of productivity, and managing the soil so as to maintain the proper chemical, physical, and bacteriological conditions. As was emphasized at Hot Springs, in most parts of the world the solution to this problem is some form of mixed rotational farming.¹ Hence, an important task in many countries is diversification of production in areas hitherto given over to monoculture. Attention is already being directed to this problem in the Caribbean region and some other tropical areas. This diversification raises technical problems such as the finding of varieties of crops and breeds of livestock that suit the local conditions. It also raises economic problems ranging from the improvement of farmers' incomes to balancing international payments. These are in most respects domestic problems, but they may be common to more than one country, so that an exchange of ideas and experience could be of great advantage.

88. In the matter of increasing crop yields, the right use of fertilizing materials is of supreme importance. A great deal of experimental work has already been done on this subject, the general principles are well understood, and the different values of animal manure, green manure, and artificial fertilizers clearly appreciated, but the results of such work can be put into practice only after specific experimental work has been done in all the chief farming regions of the world. Until

¹Hot Springs Resolution XV.

recently this work was confined to the advanced countries. An enormous amount remains to be done in countries where practically no nutrients of any sort are applied to the soil. Even after this knowledge is obtained there will remain formidable problems of how to apply it in practice. For example, the application of all the farm-yard manure of China and India to their fields would raise problems of supplying some other reasonably cheap fuel. This would involve questions of expanding local forests and woodlands, or providing other fuels.

89. Another aspect of the fertilizer problem is how to supply artificial fertilizers at such low cost that they can be more generally used. Any practical solution would seem to tie in with water conservation and the development of hydroelectric power resources and with schemes for industrialization. It would also tie in with arrangements for the postwar utilization of new chemical plants which have been greatly expanded in many countries to meet wartime military requirements; these plants could produce synthetic nitrogen and possibly other fertilizer constituents.

Recommendation

90. The Committee recommends that :

FAO consider conducting an immediate survey of postwar needs for fertilizer, of available supplies of raw materials, and of the adequacy of facilities for fertilizer processing. This should include consideration of the number and extent of wartime expansions in fixed nitrogen plants and other chemical plants suited for fertilizer production and of plans for their postwar use. If found desirable, FAO might initiate international discussions looking to the development of programs for the adaptation of these plants to production of fertilizer on a scale adequate to meet the world-wide needs of an expanding agriculture.

CROPS

91. The plant breeder today is producing varieties of crops that will flourish far from their original homes: soya beans, for example, have been acclimatized to Southeast Europe and to the United States, and new varieties of potatoes have been developed suitable for a wide range of conditions. Vernalization is also increasing the range of plant growth. New successes are constantly being achieved in the production of disease and insect-resistant varieties of crops. Although important everywhere, these may have particular significance for the tropics and other "difficult" areas. Varieties are being produced which give much higher yields per acre. Varieties of superior nutritional quality are beginning to be developed. In a few of the advanced countries knowledge about all this work reaches the farmer speedily, but in the main it creeps around the world at the pace of a sailing ship instead of with the rapidity of the airplane.

92. In fungicides and insecticides, too, there is opportunity for international interchange of knowledge. Wartime developments have created increased opportunities for effective disease and pest control. Many of the most useful sprays and dusts are now so cheap as to be within the reach of many small-scale farmers, or governments could

arrange to provide them without undue expenditure. Often all that is lacking is knowledge of their existence and arrangements for making them available.

LIVESTOCK

93. Scientific research has enabled farmers to increase the efficiency of their livestock enterprise, breeders have greatly improved the productivity of the animals, and veterinary services have aided in the prevention and control of diseases. A clearer understanding of animal nutrition and of the nutritive significance of various feedstuffs has led to marked improvement in feeding practices and methods, with a growing use of livestock rations balanced with respect to protein, minerals, and vitamins. Serious pests and diseases have been studied and cures have been worked out, while great progress has been made in methods of control and prevention of diseases. Tuberculin testing, the control of cattle ticks, inoculation of calves against Bang's disease, use of hog-cholera serum and hog sanitation practices, are examples. Animals have been bred for specialized types of production, for particular local environments, and for greater production. A start has been made on artificial insemination of cattle, resulting in increased efficiency in the use of improved genetic strains and reduced farm costs. All these developments have greatly increased the efficiency of livestock production in some of the more developed countries, and made it possible to raise livestock successfully in other less favorable regions. Many of these methods and some of the improved genetic strains could be used more generally in other countries, at least under conditions similar to those for which they were developed.

Recommendation

94. The possibilities of improvement are large in all classes of livestock. Proposed measures with respect to dairy cattle and poultry, which are especially efficient in the production of protective foods, are discussed in detail in another section of this report. But equally large are the opportunities to improve the productivity and efficiency of beef cattle, sheep, pigs, draft horses and cattle, and other domestic animals. The Committee, therefore, recommends that :

In due course FAO should organize material and facts with respect to these domestic animals, and should aid its Member nations to improve all phases of livestock production. In this connection, FAO might well develop international conventions for submission to governments providing standards covering drugs and biologicals for livestock, feedstuffs, and related products for which uniform standards in international trade may be desirable.

MACHINERY AND EQUIPMENT

95. Considering the important place of machinery in the farming of the Western world and of the Soviet Union, it is strange that a larger amount of systematic research work on farm machinery has not been done by public agencies. Only a few countries have institutions that concentrate on investigating the design and use of machines or on analyzing the manual processes of farming with a view to determining which operations are most costly and laborious and most in need of being mechanized. Increased attention needs to be devoted to designing hand

tools, implements, and machines that are sufficiently simple and inexpensive to bring them within the reach of a far larger group of farmers. Operations involving large expenditures of energy, such as pumping water for drainage or irrigation, can be greatly speeded by substituting mechanical power for human or animal muscle.

96. The application of mechanical methods has been limited mainly to the countries of the Western world where wages have been so high that machinery is worth while, but there are reasons for expecting a wider adoption in the future. If programs of world economic development provide industrial employment for many farm workers who at present are not fully employed, incomes of a larger proportion of the world's farm population will rise to levels that justify at least a modest use of machinery.

97. The successful development of machinery suitable for medium and smaller sized farms would not only reduce the amount of physical labor required, but would effect a saving of time. A man or woman who has continuously to work long days at hard physical labor has little opportunity to plan the organization of his own farm, keep in touch with technical developments, or enjoy the usual amenities associated with a full life. Governments should encourage work by national agencies or other bodies directed toward designing tools, implements, and simple machines that will be adapted to the special conditions of various countries, especially for the smaller sized farms, and measures to help supply them to workers who need them but are unable to buy them. Whenever possible they should be produced on a mass production basis in order that they may be sold at the lowest possible price.

98. When the machines are inevitably larger than a small-scale cultivator can afford, cooperative arrangements for purchase and use might be developed. In Bulgaria, interesting experiments have been made in this direction. In the Soviet Union, much progress has been made in the development of machinery that is fitted to the operation of collective farms and in the pooling of machinery in Machine Tractor Stations to serve a number of collective farms.

99. Finally, the scope for machinery is immensely widened as soon as power is available at a cheap rate. Low-cost liquid fuels encourage certain mechanical applications, such as tractors, while inexpensive electricity stimulates others. National tax policies or other policies that make fuels and energy cheap or dear thus may stimulate or hinder the utilization of machinery.

100. In addition to better mechanical devices, there are great opportunities to save farm labor and to improve farm efficiency through the application of the principles of scientific management to farm operations, farm buildings, and farm layout. Scientific studies of the arrangements in buildings, the sequence of operations, and the convenience of equipment for getting the work done will reveal many opportunities for simplifying farm work, saving unnecessary labor, and increasing efficiency. Savings by substituting brain for muscle may frequently be just as important as those from mechanical innovations.

Recommendations

101. In addition to the specific functions suggested in paragraphs 86, 90, and 94, there is a wide variety of functions that FAO might appropriately perform in aiding its Member nations on measures with

respect to soils, crops, livestock, machinery, water management, land reclamation, and maintenance and restoration of productivity. In addition there are some functions that apply to all aspects of FAO's work, such as summarizing scientific progress, organizing a scientific clearinghouse, surveying problems and programs, and preparing panels and expert missions. These latter functions are so particularly significant for technological production problems, however, that they are included here. The Committee recommends that FAO should :

(1) **Summarize scientific progress.** To summarize scientific progress will entail compiling information on scientific developments and encouraging or developing international abstracting services.¹ One special project requiring early attention will be to see that concise and authoritative summaries of the scientific advances made during the war years are prepared in each major agricultural field, and to make these summaries available to governments. This will help fill in the gaps in knowledge of recent discoveries that have been caused by the interference to communications during the war, and will make the latest results of research readily available to all countries.²

(2) **Organize a clearinghouse for scientific information.** Several organizations, national or international, are engaged in abstracting reports on scientific progress in various fields. FAO should survey the extent to which such bodies cover the whole field, and the extent to which such work can be brought together and amplified, so as to enable workers in each field no matter where located to keep up to date on the latest developments, and to be able to secure quickly and easily authoritative summaries or reproductions of the conclusions reached.

(3) **Survey problems and research programs.** This type of work will include the summarizing of major urgent problems that await scientific research in each country and lines of research under way ; it will include convening of groups of workers who are interested in particular specialized fields and encouraging them to coordinate their projects and to undertake research on related phases of the problems.

(4) **Form panels of experts and provide missions.** The study of problems connected with soils, irrigation, drainage, etc., especially in the less advanced countries, will require study on the spot by competent teams of experts. FAO should prepare panels of specialists, recognized authorities in various fields, who would be available upon request for consultation by governments. From these panels technical advisers would be selected to serve on missions to individual countries.

(5) **Integrate programs for the development of agriculture.** FAO should be prepared to advise countries of ways in which

¹ Hot Springs Resolution II.

² Two memoranda (Subcom. on Agric. Prod. Misc. 3.) providing a brief preliminary summary of such developments have been placed in the files of the United Nations Interim Commission on Food and Agriculture. They are *Scientific Developments Useful in Maintaining or Increasing Production and Science in Agricultural Production*.

programs dealing with various aspects of the development and use of resources that are important to agriculture might be integrated, both nationally and regionally where appropriate, to produce the most effective results. This would include programs on soil conservation, control of flood waters, the provision of irrigation, the development of hydroelectric power, afforestation, marketing facilities, and agricultural re-orientation. It would involve consideration of pertinent programs in nonagricultural fields such as transportation facilities, establishment of new industries, and general industrialization. Upon request, FAO should aid countries in devising comprehensive plans based on due consideration of all these fields. These comprehensive plans should be prepared in cooperation with appropriate international agencies and the governments concerned.

(6) Study methods of financing programs for the development of agriculture. FAO should study methods that have been used in financing irrigation, drainage, soil conservation, and related agricultural resource and developmental projects, and be prepared to advise countries on methods and means of financing such projects. It should be prepared to advise the projected International Bank for Reconstruction and Development concerning the requests for loans for agricultural development which it may receive from Member countries.

INCREASED PRODUCTION OF PROTECTIVE FOODS¹

102. Poverty is the first cause of hunger and malnutrition.² It attacks primarily through underconsumption of protective foods, for these are scarce and expensive. If the people of the world are to be better fed, a larger and less expensive supply of certain foods is essential. There are many different ways of getting the essential nutrients which are most generally deficient in human diets, but milk, eggs, vegetables, and fruits provide some of the best sources. Measures to increase the production of these foods therefore deserve early attention, both by governments and by FAO.

DAIRYING³

103. Whole milk supplies high-class protein and many other essential nutrients, and its consumption should be increased wherever possible. Because of the high cost of milk in labor and land, compared with that of many vegetable products, it is not desirable to encourage dairy production in all regions without regard to their resources. In certain tropical countries the maintenance of dairy herds is now too expensive for large-scale production; in others, crop areas are too limited to grow the necessary livestock feed. In many countries most people cannot

¹ "Protective foods" are used in this report in the same sense as in the Final Report of the Mixed Committee of the League of Nations. There they were defined as "those chiefly valuable for providing minerals, vitamins, and 'good' protein." See League of Nations, Mixed Committee on the Problem of Nutrition, *Final Report . . . on the Relation of Nutrition to Health, Agriculture and Economic Policy*, Geneva, 1937: pp. 63-65.

² Hot Springs Resolution No. I.

³ United Nations Interim Commission on Food and Agriculture, Technical Committee on Agricultural Production. *Report to Panel Subcommittee on Agricultural Production from the Dairy Group*, Washington, October 20, 1944, Dairy Dec. 20.

afford substantial purchase of dairy products, whether domestic or imported.

104. Considering world dairying as a whole it would seem that the greatest opportunities for increasing output lie in the countries intermediate between the old-established dairying regions and the very difficult areas. It is in these intermediate areas, where much scientific work remains to be done, that FAO may find much to do in pooling advice and coordinating research. Admittedly an extension of production will be easiest in the older dairying regions, but how large the market will be for that extra output is not known. Hence, the speed at which the expansion of dairy production and consumption can be carried into effect will need to be coordinated with the rate of general progress toward world prosperity and industrial expansion.

105. The phenomenal increase in dairying during the last forty years was most marked in a few areas—Europe, North America, Australia, and New Zealand. The increase in the consumption of milk and dairy products also took place largely in these same regions. Before the war, foreign trade in dairy products consisted mainly of shipments of butter and cheese from the New World to the countries of Northwest Europe or between the countries of Northwest Europe. In these regions, there has been less difficulty in increasing production than in others, and per caput consumption of dairy products has been high. Their postwar interest centers on the probable levels of demand and on the location of markets.

106. In the dairying regions of Europe, the first concern will naturally be to recover from the war, to build up dairy herds again, to de-ratation milk, cheese, and butter, and to reestablish foreign trade relations. In some of the countries of eastern and southern Europe, which before the war concentrated on food-grain production more than on livestock, there might well be some increase in dairying.

107. In western Europe as a whole, only a modest proportion of all milk produced is consumed in fluid form. Much could be done to improve human nutrition with existing milk supplies by utilizing more of the whole-milk solids for human consumption, feeding less skim milk and whole milk to livestock, and—if economical transport is available after the war and trade barriers do not prohibit such action—by shipping liquid milk from one country to another. Although there will undoubtedly be a continued increase in world consumption of dairy products taken as a whole, further study and joint planning will be needed before each country can judge how much it should increase its own dairy industry.

108. There is no reason, however, why in all the countries that have advanced dairying the average milk yield per cow should not exceed 3,000 liters per year as it already does in Denmark, Belgium, and the Netherlands. Higher output can be obtained by further advances in animal breeding and nutrition, feed production, disease control and prevention, and dairy hygiene.

109. Dairying is relatively little developed in most of South America, large parts of China, India, the Soviet Union, many Mediterranean and Middle Eastern countries, southern and southeastern North America, and most of Africa. In all these lands there could be more dairying; in some only a little more, but in others a great deal.

110. In these areas there are, broadly speaking, four groups of problems: development of appropriate breeds, supply of necessary feed, eradication of diseases, and development of marketing facilities. Already much breeding work has been done to improve the productivity of local cattle, buffaloes, sheep, and goats. Crosses of native cattle with high-yielding European breeds and with Zebu cattle, and improvement of water buffaloes for milk, have been especially noteworthy. This work needs to be continued. In many areas feed supplies are the limiting factor. Production of feed crops will need to be expanded and pastures improved by better farming methods. In many places large-scale irrigation is a prerequisite to more feed production. The fight against disease and pests that affect dairy cattle will entail the establishment or extension of veterinary service and control measures, and the improvement of livestock sanitation on the farm. Finally there are marketing and sanitation problems, including the provision of rail and road transport and, in the case of liquid milk, of equipment for keeping it cool and pasteurizing and processing it promptly at local stations. Often marketing facilities for liquid milk will be so costly that milk will have to be turned into butter or cheese on the farms. In less advanced countries where adequate protection from contamination is generally lacking, the possibilities of spreading epidemics from the use of liquid milk are very great. Wider use of processed milk, including dried whole or skim milk, either imported or produced domestically, may offer a practical way to increase milk consumption in many of these countries.

111. Prospects are good for an expansion of dairying in many of these areas but it will inevitably be a long-term program. Increased production of other protective foods such as poultry and vegetables should therefore be stressed first in most of these regions.

112. Many conditions make it difficult or impracticable to develop milk production in most tropical areas. Breeds developed in other regions do not stand the climate, and the development of acclimatized breeds has been slow. Diseases and pests abound, and measures for their control have been only partly effective. In many regions it is hard to grow suitable feedstuffs for dairy herds and too expensive to import them. In other areas crop acreages per caput are too limited to support any livestock industry, and practically all the available land must be used for crops for direct human consumption. Finally, the great care and special equipment necessary in marketing milk, including adequate transportation and cooling, will be extremely difficult to provide.

113. Where communities are able to pay the necessary price these difficulties can, of course, be surmounted. In many urban centers in tropical countries, liquid milk was provided before the war for the well-to-do population, but the cost put it entirely out of the reach of most of the population. And it was among them that diets were most deficient.

114. In some tropical areas, notably the Caribbean, research is under way that may hold prospects for the establishment of dairy industries on a reasonable economic basis, although the work is not sufficiently far advanced as yet for a positive judgment to be made. In the meantime, the alternatives of importing milk products or of developing other nutritionally valuable foodstuffs should be examined even though

the limited purchasing power of most of these areas limits the scope for increased imports. Fluid milk reconstituted from butter and dried skim milk, or dried skim milk used in other foods or simply mixed with water, can be supplied at moderate cost far from the region where the original milk was produced. It may be, however, that the best prospects in many areas lie in expanding the production of other protective foodstuffs and in providing vitamin and mineral fortification for some of the present foods.

115. The following initial policies in dairying for the first few years after the war are suggested :

(1) In areas of previous high production, encourage restoration of herds and output and the expansion of milk consumption by education in nutrition and by special schemes for the disposal of milk.

(2) In less developed dairy areas where food-grain output was stimulated before the war by autarchic policies, encourage reorientation of agriculture toward more intensive production, more livestock, and more dairy output. Output should be expanded also in areas adjacent to expanding industrial centers, where conditions for fluid milk production are favorable, and in less intensive areas of abundant forage and good conditions for dairying.

(3) In other regions, of inadequate or unfavorable land area, rely upon increased imports of canned and dried milk, together with increased local food supplies from vegetable proteins and possibly poultry and fish, to improve diets.

(4) Where demand for whole milk increases more rapidly than can be satisfied from local supplies, improve the nutritive effectiveness and economic value of milk production by increasing the proportion consumed by human beings as whole milk. This would involve shifts in farm and marketing practices.

Recommendations

116. To implement these policies, the Committee recommends the following initial steps by FAO :

(1) **Production.** In countries with less advanced dairying, FAO should encourage governments to collect necessary scientific and economic information concerning possibilities for dairy production, and aid them to analyze it and develop dairy programs based upon it. In tropical countries, FAO should encourage governments to investigate and determine how and to what extent dairying should be developed.

(2) **International arrangements.** Besides this work with individual countries, FAO should promote international arrangements with respect to dairy products. These might cover (a) standards for the sanitation, grades, and quality of dairy products entering international trade, (b) measures for the reduction or elimination of cattle diseases or pests, and (c) the international movement of milk and dairy products, to assure reasonable prices and adequate supplies and to avoid erratic fluctuations in volume.

(3) **Marketing and consumption.** In addition to the measures recommended in the production field, an integrated approach

by FAO to the expansion of dairying would involve measures to reduce marketing costs and to encourage increased consumption. With respect to marketing, FAO might conduct studies of methods of marketing milk in countries with advanced dairying to determine the most practical and efficient methods and how they have been developed, and then encourage governments to take steps to eliminate unnecessary services and reduce marketing margins in areas where milk marketing has become unduly complicated and expensive, and to develop more modern marketing facilities where present arrangements are still inadequate. It might study the possible gains and costs of using more whole-milk solids for direct human consumption. Where milk supplies cannot readily be expanded to meet expanding demands, it could encourage the increased use of whole milk and milk solids for direct human consumption, and might aid importing and exporting countries to develop coordinated programs to this end. To supplement these steps, it would be desirable to aid in training technicians and leaders for sanitary control in marketing and processing, and to aid in the formulation of marketing programs. In areas that do not have effective milk marketing facilities, caution in adapting marketing and sanitation procedures from advanced countries to less developed areas would of course be necessary.

Direct action could be taken to stimulate milk consumption. To facilitate this FAO could study what methods have been most effective in directly stimulating consumption, assemble and provide countries with the latest scientific and educational information on the value of milk in nutrition, and otherwise aid governments to develop nutritional education and stimulate consumption in those countries where economic or production possibilities make this feasible. It could also cooperate with governments in studying supplementary milk-consumption programs already in operation, and in encouraging the expansion of such programs in so far as is feasible.

POULTRY¹

117. Eggs are a valuable food, furnishing minerals, vitamins, and high-quality proteins. The Food and Nutrition Board of the United States National Research Council recommends five or six eggs per person per week in liberal diets. Consumption is far less than this in poor countries and among the poorer people in prosperous countries. In such cases, and especially where other animal foods are not available, increased egg consumption is an effective means of raising nutritional levels. Even where more vegetables offer the most economical way to add needed nutrients to the diet, the use of some eggs is a valuable nutritional safeguard. Poultry meat, moreover, is a nutritionally worthwhile by-product of egg production, and on small farms can contribute materially to the food supply. Ducks, geese, and other birds, and in some places rabbits, can be of considerable local importance.

¹ Summarized from United Nations Interim Commission on Food and Agriculture, Technical Committee on Agricultural Production, *Report to Technical Committee on Agricultural Production from the Poultry Group*, Washington, November 24, 1944, Agric. Prod. Doc. 7.

118. Poultry keeping is practically universal throughout the world, except in regions that are extremely cold. Even the poorest farmers in the poorest regions are likely to keep a few hens. Indeed no farm animal is so widely distributed or so universally familiar as the hen.

119. Poultry are short lived, reproduce rapidly, and in small flocks require very little land and do not demand much time-consuming care or elaborate equipment. Vast numbers of the world's poultry subsist on scraps, gleanings, or by-products of foods that would not be used by human beings. Careful study is likely to reveal many opportunities for increasing the supply of such products for poultry feeding. Thus even under rather extreme conditions of poverty, a limited amount of poultry keeping can represent a net addition to the food supply and add to the farmer's cash income, as well as supply by-products such as manure and feathers that have an additional cash or use value.

120. In countries or areas where poultry keeping is a well-developed commercial enterprise, a highly developed commercial poultry farm is practically a biological manufacturing plant in which—although there is still much to be learned—the findings of science on breeding, feeding, disease control, and management are used throughout. Production per hen is relatively high; in some countries the average reported for all farms is around 120 eggs a year, while the record of the best flocks is around 200. The vital factor to the commercial poultry producer is the cost of feedstuffs in relation to the price of eggs. Hence, where feedstuffs cross national boundaries, barriers to trade can greatly restrict specialized poultry production.

121. On the other hand, in countries or areas where poultry are kept largely for subsistence, production is for the most part inefficient. Little or no attention is paid to breeding, and the birds are inherently low producers, often averaging not more than 50 small eggs per bird per year. Diseases, parasites, and predatory animals take a heavy toll, and in some cases destroy entire flocks. Feeding is haphazard and inadequate. Housing is poor or entirely lacking.

122. It has been demonstrated, however, that production can be increased economically and quickly once a vigorous program is undertaken. In at least two countries, Bulgaria and Iraq, a program of this sort has been successful in winning widespread cooperation. In Bulgaria, the central point for poultry development has been a village cooperative society which acquired an incubator and with the aid of one or two moderately experienced persons distributed high-quality chicks to the farmers and advised on feeding and disease control.

123. These programs, by showing what can be done elsewhere, may be a general guide on how to proceed. Certain countries already have teams of people experienced in this work. In many cases such poultry development is capable of yielding results far more quickly than progress in most other fields of agriculture.

124. In regions of small-scale poultry production—for example, India, China, parts of the Balkans, and certain countries in Central and South America—the handling and marketing of eggs is likely to be as primitive, wasteful, and inefficient as the production. There are no refrigeration facilities to store eggs from flush period to short ones; packing is crude and breakage excessive; eggs are either collected at irregular—sometimes very long—intervals by commercial agents who

go from farm to farm, or are brought to market in small lots by the producers. Even where there is railroad transportation, eggs do not get proper handling. All this means unnecessary losses to both producers and dealers and contributes to the scarcity, the high price, and the poor quality of eggs in towns.

125. In the more advanced countries a large proportion of the egg supply is produced from farm flocks kept as a supplementary enterprise on general farms. Such flocks are not handled as intensively as specialized commercial flocks but reasonable care is generally exercised in collecting and marketing the eggs, practices such as candling and grading the eggs ensure a good product; and facilities for cold storage even out consumption through the year. These countries also have highly developed commercial areas where many eggs are produced in large specialized flocks; the eggs are collected promptly, moved quickly to retail sale or stored under refrigeration, and handled and marketed with careful consideration for maintaining quality. Even in these countries where consumer acceptance is generally high, people with low incomes would eat more eggs if they were not such a comparatively high-priced food. This fact emphasizes strongly the need for reducing the costs of production and marketing so that the product can be sold at the lowest economic price.

Recommendations

126. The Committee recommends that FAO take the following steps:

(1) Stimulate and help to coordinate research on poultry breeding and management problems, with special reference to the areas of the world where hitherto there has been little expansion and where much nutritional benefit could result; and encourage the development of veterinary services, and their application to the control of poultry diseases and parasites. FAO should give special attention to countries developing programs for improved small-scale poultry production; should survey, in cooperation with governments, methods of marketing eggs; and should prepare practical recommendations as to how adequate marketing services, including storage facilities may be developed at the least cost.

(2) Help bring together information on the nutritional value of eggs, and encourage countries to stress that value in nutrition programs.

(3) Make a general survey of the world poultry situation, including a series of poultry statistics, and prepare a bibliography of poultry literature; draw up a panel of poultry experts of international repute, and be prepared to send out missions to advise on development programs or the training of leaders in countries requesting such help.

VEGETABLES AND FRUITS

127. Increased consumption of vegetables and small fruits offers one of the readiest and cheapest ways to improve nutrition for farm and city families alike, since vegetables of special nutritional value can be grown in most climates of the world, not only on farms but also in the gardens or allotments of many millions of city workers. The

provision of many of the scarcest nutritive substances is derived directly through fruits and vegetables, as crops for human consumption, rather than indirectly through livestock. Wartime expansions in vegetable production in many countries illustrate how rapidly production can be stimulated by governments. There is particular need for emphasis on vegetable production in countries of limited resources, where provision of increased animal foods will be slow and difficult. In addition, production of fruits of high nutritive value, notably citrus fruits, can be expanded in many regions, though they take somewhat longer than vegetables to start producing.

128. It is desirable that all farm families grow sufficient vegetables for themselves. Enough land can be spared on most farms and necessary work can be done without interfering with regular farm products. Much can be done to overcome local difficulties of soil and climate through irrigation, manure and fertilizer, improved and adapted varieties, cold frames or hot beds, and windbreaks. Because habit, dietary customs, and lack of knowledge or skills may have to be overcome in many areas, educational efforts are needed to stress which vegetables are nutritionally most important, and how a continuous supply of fresh or processed products can be provided throughout the year.

129. More vegetables for city people can come in part from allotments and family gardens, so extensively developed during the war. In large measure, however, city consumers will depend on increased commercial production. Improved methods of marketing, transportation, and processing are needed to get the product to consumers promptly, regularly, and at minimum costs.

Recommendation

130. The Committee recommends that :

FAO should give early attention to problems involved in increasing the production of vegetables and fruits especially in the less developed countries and to maintaining the wartime increases in vegetable production and consumption. It might conduct an immediate survey of methods used to stimulate both home vegetable gardens and increased local supplies during the war period, and report which of these wartime methods could be adapted to peacetime use. It should make a comparative study of vegetable marketing systems, and report to governments on most effective methods for their improvement. It should study the newer and wartime methods of processing especially dehydration and quick-freezing, their applications in various countries, and their suitability for peacetime use. It should develop panels of vegetable experts, and be prepared to render aid to countries through missions or otherwise.

OTHER PROBLEMS AFFECTING AGRICULTURAL PRODUCTION LAND PROBLEMS

131. Considerable regions of the world still await agricultural development. Most of the Brazilian uplands, for example, and large parts of Central Africa, Madagascar, Sumatra, Borneo, and New Guinea are agriculturally virgin. Even in South China only one fifth of the land is cultivated. Although agricultural production could be

increased in these and other areas by closer settlement of areas at present little used, such ventures would require the solution of a number of technological, economic, political, and social problems before they could succeed. The past experience of other nations in such programs could profitably be drawn on. To this end, it might well be a function of FAO to prepare a comprehensive documentation of past experience in land settlement and to provide on request expert technical advice in this field.¹

132. In many regions improvements in agricultural production are retarded by the arrangements under which the actual operator holds his land. It is generally believed in most countries that the best system of land tenure is for the land to be owned by the farmer who occupies and tills it. Steps to break up large estates into smaller family farms were taken in several countries after World War I. The experience accumulated in these efforts may be helpful to countries attempting similar land reforms after World War II. Even after large farms are split up, other perplexing problems may arise. Too many farms may be acquired by absentee owners, for example, or many farms may be too small for the owner-occupier to make a reasonable income for his family. The resident farmer may lack the capital or equipment to farm properly, or he may be in difficulty because too much of his gross income goes to pay interest on debt. Moreover, the custom of dividing actual land among heirs often intensifies the difficulties associated with farms of inadequate size. Here, too, the experience of countries in preventing this division of the actual farm, in supplying credit, equipment, and guidance to small owner-operators, and in consolidating undersized farms may be helpful to other countries faced with the same problem.

133. Even under owner-occupancy, difficulties may develop because of the dispersion of land into many widely scattered, uneconomically small plots or strips such as are common in large areas of Europe, India, and China. Modern farming practices are impossible under such conditions. Consolidation of strip farms into homogeneous blocks may involve replanning the village layout, moving buildings, constructing roads, and supplying water, in addition to surveying and valuing the plots and organizing their exchange among cultivators. Many countries, including the Netherlands, Switzerland, and Germany, have had extensive experience in such strip consolidation. This experience should be useful to other countries interested in organizing land consolidation schemes.

134. In some countries effective legal arrangements have been developed by which the tenant is protected in many of his rights in and toward the farm. These include in the United Kingdom, for example, under the various Agricultural Holdings Acts, compensating tenant farmers for improvements, guaranteeing them security of tenure, and holding them responsible for dilapidations. Such arrangements for guaranteeing farmers security of tenure offer an attractive alternative to owner-occupancy in the form of a legally stabilized landlord-tenant relationship. They permit the tenant to use all his available capital in the stocking and equipping of his farm without having to invest a large proportion in the purchase of land. In this way, the tenant can frequently farm on a larger scale with the prospects of a better

¹ Hot Springs Resolution XXI.

standard of living. Such arrangements, however, require that landlords be both able and willing to invest in their estates as much capital as is socially desirable.

135. In some areas, such as the United States Cotton Belt, tenancy has developed into a system in part of hired laborers working under close supervision with no capital of their own, and in part of small tenant farmers with little capital, also closely supervised. Both sharecroppers and share tenants receive only a share in the crop in return for their labor. Under this system the tenant has no responsibility for care of the soil and usually pays little attention to producing protective foods for family consumption. The owner, moreover, generally has taken a minimum of care of the land or buildings. This system thus tends to condemn the farm operator to continuous poverty and the soil to exhaustion. Substantial progress in correcting this situation in the United States has been made during the past ten years by the Farm Security rural rehabilitation program. One part of this program involves loans to sharecroppers or share tenants based on an agreed-upon plan for farm management and home consumption. The carrying out of the plan is supervised by a local public official.

136. Operation of land in collective farms, with a large number of families pooling their equipment, operations, and returns, has made much progress in the Soviet Union, and has aided in the introduction there of improved farming practices. Somewhat similar systems of cooperative farming have been experimented with in a few other European countries.

Recommendation

137. The Committee recommends that :

FAO's major function regarding land tenure problems should be to collect and summarize the experience of different countries in dealing with various phases of tenure and to make its conclusions available to all countries. FAO should take advantage of whatever information in this field has been gathered by other international organizations. FAO's work should include an analysis of the legislative and legal provisions and administrative arrangements used and of the results obtained. With respect to problems where there has been specific governmental action, such as consolidation of crop strips, breaking up of large holdings, or provision of supervised credit, FAO should arrange to have panels of experts with experience in such undertakings available to visit and to advise countries requesting such help.

LABOR

138. Farmers traditionally have been among the low-income members of almost every community. Farm laborers generally have fared even worse. Increased income to both farmers and farm workers thus is essential if the basic objectives of FAO are to be reached, since in addition to the significance of farm workers and their families as consumers, farm workers are essential factors in production. Although the use of hired labor is not general in agriculture, in practically all countries there is a small proportion of large or specialized farmers who regularly employ some full-time labor. Small or family-size

farms frequently need additional labor to help meet seasonal peak labor requirements at planting and harvest time. Getting the help needed in the right amounts and at the right times is essential to farm production, but the extreme seasonality in many requirements for farm labor often has made it difficult to meet farm needs and at the same time provide reasonable working and living conditions for the workers and their families. The problem of establishing satisfactory conditions for migratory workers is particularly acute, especially where citizens of one country do seasonal work in other countries.

139. In the developed countries, social measures needed to improve the position of farm workers include steps (1) to bring farm wages more in line with those in other industries ; (2) to provide suitable housing ; (3) to provide full-time workers reasonable time off weekly, and annual vacations with pay ; (4) to provide casual or migratory workers reasonable conditions for themselves and their families with respect to working conditions, housing, and schooling ; and (5) to extend the coverage of social security measures to all farm workers, as well as to farmers. As a prerequisite to most of these measures, it would be necessary to make it possible for employing farmers to pay the increased wages and other costs. Already much progress has been made in these directions in some countries, as under the United Kingdom's National Wages Board and social security provisions. In all countries, including the highly developed ones, a great deal remains to be done.

140. In some less advanced countries, also, measures have been developed to improve the health and educational opportunities of the workers, to provide minimum standards for migratory workers, and to prevent discrimination against groups or the exploitation of workers through hours worked, or rents charged where crop-share arrangements are used. In all underdeveloped countries such measures should be further extended concomitant with efforts to improve the general efficiency of agricultural production. The general levels of agricultural production and efficiency must be raised to reasonable minimum levels before either farm workers or farmers can attain satisfactory standards of living. Additional measures of the sorts outlined in the preceding paragraph can be introduced gradually as improving standards permit, to ensure that farm workers share equitably in the increases in the income and welfare of agriculture. Measures to help surplus rural populations shift into more advantageous industrial employment, as recommended elsewhere, will also help raise the economic position of the remaining farm workers in these countries.

Recommendation

141. The International Labour Organisation has for many years had responsibility for international action in the field of labor. Many of the activities of FAO, however, will have effects upon labor. The Committee recommends that :

At an early stage FAO should consult with international organizations concerned with labor, health, education, and other matters affecting the interests of agricultural workers to determine how their cooperation in this field may best be arranged. Between them, the two international organizations should ensure that the collection and publication of information from various countries on the following points be adequately provided for—

(1) Official regulations concerning wages and conditions of employment of hired workers in agriculture.

(2) Methods that have been used to improve the working conditions of agricultural labor, and to secure a better adjustment of labor supply to farmers' needs.

(3) Steps taken to extend social security provisions to employed farm workers, self-employed farmers, and unpaid family labor.

(4) Special measures taken to improve the housing, educational and health opportunities, and general conditions of living of employed farm workers and their families.

(5) Special measures employed to deal with the problem of migratory workers and seasonal farm workers, from the viewpoint both of improving the conditions of the workers and their families and of meeting the labor needs of farms and agricultural processing industries.

COOPERATION

142. Cooperative activity has already been mentioned in several parts of this report. It is desirable, however, to stress the value of the cooperative movement as a whole as a proved instrument for increasing the efficiency of agricultural production and marketing, and for improving the economic and social status of the farmer. In the countries where cooperation has taken firmest root, as for example in Northwest Europe, it has helped the small farmer to compete effectively with the large one. Although originally formed for processing or sale of produce, the purchase of materials used in production, and the organization of farm credit, cooperatives have developed in many other spheres, including crop and livestock insurance, and nation-wide and even international marketing and distribution. Other cooperatives have been formed for such purposes as the provision of water facilities in villages, the acquisition and the operation of farm machinery, and even the cultivation in common of the villagers' lands. In many cases cooperative organizations have formed the nucleus for marketing boards—or schemes or other agricultural administrative arrangements, under which public recognition or public powers were conferred on the producer agency.

143. In a number of the less advanced countries cooperatives have as yet made little progress. There can be no doubt, however, that as these countries develop their agriculture and industry the scope for cooperative organization is likely to be large indeed, and that cooperatives will be key agencies in carrying agricultural programs to realization.¹ Although governments can give much help in the development of cooperatives, experience suggests that cooperative organization has to be built from below upwards rather than the reverse, and has to be rooted in the community and staffed by local leaders.

Recommendation

144. The international organizations concerned with labor and perhaps with credit and other matters will have an interest in various phases of cooperative activities. The Committee recommends that :

¹ Hot Springs Resolution XVII.

FAO should consult with these organizations on mutual interests in this field. Studies should be made particularly (1) of agricultural cooperative methods in different regions, (2) of special legislation facilitating or limiting the development of cooperatives, and (3) of the relationships of cooperative organizations to governments. The result should be made available to governments wishing to assist their people in developing cooperative activities. Missions or groups of experts should be sent on request to advise governments on problems of cooperation.

CREDIT

145. The need for agricultural credit has been referred to in connection with land tenure, soil conservation, introduction of machinery, and improvements in marketing. Many of the particular problems of agricultural credit were discussed in the memorandum submitted by the Interim Commission to the United Nations Monetary and Financial Conference held at Bretton Woods.¹ Here it is necessary to emphasize that far-reaching programs for increasing agricultural production cannot be undertaken unless adequate capital is available, and this must for the most part be in the form of credit to farmers.

146. Many countries do not have the financial resources to provide all the credit they need for their own development.² International credit on a massive scale will be needed for the industrialization of many overpopulated agricultural countries. Without that industrialization agricultural improvements cannot prosper. International credit may also be needed for some of the larger agricultural projects, particularly those of an over-all character, analogous to the Tennessee Valley Authority in the United States, which involve the development of land and water resources of a whole area. Since such projects may not look productive by ordinary commercial standards, it may be important that large agricultural developments of this type include the establishment of some income-yielding assets, such as the building of large hydroelectric power plants or of factories for the manufacture of fertilizers.

Recommendation

147. The Committee considers that :

FAO may be of definite service in advising those countries which have not yet established satisfactory credit facilities. It should collect and put at their disposal the experience of the many countries in which agricultural credit institutions flourish on a sound basis. It may be able to arrange for the loan of credit experts to countries without highly developed financial institutions. This work must be undertaken cautiously, for in countries where agricultural credit is poorly organized and interest rates are exorbitant the trouble may not only be a lack of organized State or cooperative credit, but may also derive from the system of land tenure, the level of education of the cultivators, and the general

¹ United Nations Interim Commission on Food and Agriculture, *Memorandum on Financing of Agricultural Development and the Proposed Bank for Reconstruction and Development*, Washington, June 23, 1944, I. C. Doc. 26.

² Hot Springs Resolution XVI.

unproductivity of farming. Changes in credit arrangements may be ineffective unless these other problems are attacked simultaneously.

148. The role of FAO in advising on the agricultural aspects and implications of development programs and in acting as a liaison between governments and the international bank is discussed in the memorandum already noted. Provision for such liaison has been included in the draft constitution for the projected international bank.¹ It is clear that one important duty of FAO should be to see that the provision of credit for agricultural and related development programs is kept in proper balance.

PROBLEMS OF GENERAL ECONOMIC DEVELOPMENT

149. It was clearly recognized at Hot Springs that "it is useless to produce more food unless men and nations provide the markets to absorb it. There must be an expansion of the whole world economy sufficient to maintain an adequate diet for all."² It was also recognized that the achievement of an economy of abundance would involve governmental action to advance living standards, promote the development and use of resources, supply capital, equipment, and technical skill, maintain stability in international exchange rates, improve the methods and reduce the costs of international movement of goods, and reduce barriers to international trade.³ Development of an expanding world economy thus involves measures by governments to increase production, consumption, and the exchange of goods in other fields as well as in agriculture itself.

150. It was further recognized that this expansion of the international economy must not be haphazard, that it must provide "an equitable balance between agriculture and industry in the interest of all."⁴ Increases in technical productivity, whether in agriculture or industry, do not serve mankind until they are reflected in continuous higher output or more leisure. Hence, the ability of consumers to buy and consume must keep pace with the ability of producers to produce. Furthermore, the composition of what is produced must be kept in balance with the things consumers are willing to buy. An expanding yet balanced economy therefore implies one which maintains the right balances between more goods and more leisure, more goods and more income, and between the various kinds of goods, such as between more food and more clothing.

151. As was clear from the review of the inter-war period, many countries have found difficulty in maintaining the right balance between agriculture and industry. As a country develops in productive efficiency, wealth, and welfare, a smaller proportion of its people are needed in the production of food. In less developed countries 80 percent of the population may labor at food production, in advanced ones 25 percent or less. In many countries the farm population is

¹ See Section 8, Article V, Annex B, of the Final Act of the United Nations Monetary and Financial Conference, held at Bretton Woods, New Hampshire, U. S. A., from July 1 to July 22, 1944. See also United Nations Monetary and Financial Conference, *Articles of Agreement—International Monetary Fund and International Bank for Reconstruction and Development*, Washington, 1944.

² Hot Springs Resolution I.

³ Hot Springs Resolution XXIV.

Hot Springs Resolution XXIV, subsection 1 (b).

greatly in excess of that needed for farm work. In eastern Europe a considerable proportion of the farm population could shift to other work without any reduction in agricultural output. The same situation prevails in the southern regions of the United States. In many parts of the Far East the proportion that could profitably shift is even larger.

152. It should be remembered however that economic advance may bring new difficulties of its own. In the history of the transition from less advanced to developed economies, frequently the earliest steps forward have been in sanitation and disease control which sharply reduced death rates. Consequently the population increased faster than before. But soon, the growth in agricultural and industrial productivity gathered impetus until output was expanding even more rapidly than population. In short, output *per head* was increased and standards of living rose. At that stage the rate of population growth began to slacken. It does not, of course, follow that this history will repeat itself everywhere. In the Far East, for example, it may prove difficult to get industrial and agricultural production to increase more rapidly than population, yet the attempt must be made if there is ever to be any progress away from poverty.

153. The general need for industrialization in these densely populated areas was emphasized at the Hot Springs Conference.¹ But industrialization does not have to mean the establishment of large densely populated cities, such as developed during the nineteenth century. With modern power and modern means of transportation, such centralization of industry is no longer necessary. As soon as electricity becomes available as a principal source of power, a more decentralized industry should be practicable, providing farmers with more easily accessible markets and more opportunities for employment. In view of the likelihood of a great excess of labor on farms for a long time to come in certain countries, serious efforts should be made to plan the development of numerous small local industries. In the crowded areas of the world the aim should be toward as much interpenetration as possible between agriculture and industry. Progress in this direction would provide promise of an immediate increase in family income for the poorest communities of the world, and would moderate the impact on rural communities of industrial development and the social changes which it brings.

154. Increased opportunities for employment may be provided either by moving work to the people, or by people moving to places where there is work. The problem of population movements was discussed at Hot Springs. It was pointed out there that where agricultural settlements were possible, the movement of people from overmanned agricultural areas should be facilitated, and the settlers should be assisted in adjusting themselves to their new environment and work, and be provided with economic security in the process.² Where such settlements involve material shifts or expansions in agricultural production, the question of the agricultural possibilities of production in the region selected and of its relation to the national agricultural production programs may both need to be considered.

155. Among the facilities which governments can provide to stimu-

¹Report of Section II.

²Hot Springs Resolution XXII.

late agricultural and industrial development, transportation is one of the most essential. A hard-surfaced road or a near-by railway increases the range of products that farmers can send to market. A railway through the forests or across the steppes opens new lands for settlement, relieves overpopulation, and increases food production. In many parts of the world, little growth can take place until transport facilities are improved. Millions of peasants today cannot get their goods to market. Many Indian villages are practically cut off from the outside world for several months of the year because of the lack of adequate roads. In South America large tracts of land are waiting for roads and railways before they can be settled and made productive. Thus, an important element in increasing world agricultural production and in improving the income level of farmers is a bold program for building and improving communications.

Recommendations

156. Although the effectiveness of FAO's program of increased food production and consumption will be conditioned in large measure by the nations' success in establishing an economy of expanding abundance, the responsibility for international action to forward such an economy will lie in large measure with other specialized international agencies dealing with labor, credit, transportation, communications, trade, etc. There are, however, certain functions which FAO may appropriately perform, in cooperation with such agencies.

(1) In working with governments of Member countries or the international bank on the agricultural phases of development programs, FAO should give special attention to the relocation of farm workers who are not needed on farms or who will be released under the new programs, and to the provision by the programs of adequate opportunity for industrial employment for these workers.

(2) In working with governments of Member countries on the development or integration of agricultural production plans, FAO should be constantly alert to see that adequate provision has been made for expanding the buying power available for the purchase of the expanded farm output.

(3) The agricultural programs of countries may in some cases involve the settlement or development of new areas, and the desire for settlers, involving migration either within the country or between countries. In such cases FAO should be prepared on request by the country concerned to assist in appraising the technical possibilities for the success of the settlers, in judging what effect, if any, their production and sales would have upon agricultural production programs, and in taking steps to aid the settlers to get their new farms going successfully.¹

(4) Because effective programs of industrialization are so important to the success of its agricultural programs, FAO should at an early date consult with other interested international agencies as to the status of their programs for general industrial development and expansion, ascertain to what

¹Hot Springs Resolution XXII, subsections 1 (c) and 1 (d).

extent they provide a proper balance between industry and agriculture, and do all that it appropriately can to forward and speed such programs.

157. In all these steps, FAO should pursue its broad objective of stimulating and forwarding an expanding world economy. Expansion should keep pace with technological progress, and be properly balanced as between agricultural and industrial production and internally balanced as between the various components of agriculture. Financial and social arrangements should be such that rising consumption steadily keeps pace with rising production.

REORIENTATION OF AGRICULTURE AND COORDINATION OF POLICIES ASPECTS OF REORIENTATION

158. The problem of agricultural production is one not only of expanding output but also of modifying the character of the output. In the foregoing sections some suggestions have been made for increasing the output of certain protective foods. Reorientation of this type could make an important contribution to the better nutrition of many peoples, especially among their farm populations, where better nutrition and greater prosperity go hand in hand.

159. Regions of monoculture are usually in special need of diversification. The short-term profits of monoculture in many instances have been at the expense of the long-term productivity of the soil; and the farmers' income, dependent on the fluctuations in a single commodity market, has been highly unstable. The required diversification may involve a variety of activities. Since it includes finding new crops and types of livestock suited to local conditions, farming habits must be changed. New transportation and processing facilities may be needed. New markets may have to be opened up. The effects on the country's balance of payments may have to be considered. These are real difficulties, yet a permanent and prosperous agriculture is rarely obtainable without diversification.

160. Another aspect of reorientation follows from the protectionist developments of the inter-war period which forced the agriculture of many countries into uneconomic and distorted modes and led exporting nations to try to restrict their production. To some extent the present war forced some countries toward even greater self-sufficiency. But in another sense the war liquidated many previous trading arrangements and left a fluid situation from which future growth may proceed either back to the old uneconomic position or forward to a more productive and cooperative world.

161. Resolution XIV of the Hot Springs Conference calls specifically for nations whose agriculture was impaired by the war to readjust toward better nutrition and more efficiency. It also calls for countries free from enemy action whose output has temporarily been expanded "progressively [to] adjust their allocation of agricultural resources to conform to a long-term coordinated production plan for the best use of their resources on a world scale, based on better diets for their own people and on the international demand for nutritionally better food." Success in achieving this goal will depend largely on the extent to which alternative sources of income can be developed either within agriculture itself or in other occupations. These possibilities, in turn,

will depend largely upon the progress made in industrialization and in the general development of an expanding world economy.

162. Whether it be in the wheat and sugar-beet belt of Europe, the Cotton Belt of the United States, or other regions of the world, the problem is not one of restricting output of specific products, but rather of encouraging and aiding farmers to shift to alternative products with opportunities that are more promising. In areas near consumption centers there may be opportunity for producing more vegetables, fruits, milk; and eggs. These products are relatively perishable, high in cost, and needed for better nutrition. Livestock production might be encouraged in areas capable of growing the necessary feedstuffs or shipping them in economically.¹ Where there are not adequate opportunities in farming, then opportunities for more profitable occupation will have to be provided by encouraging the establishment of new industries in the area. Undertaken in such ways, reorientation will bring greater prosperity and a higher level of general welfare.

INTERNATIONAL INTEGRATION OF NATIONAL AGRICULTURAL PROGRAMS

163. As individual countries develop programs for the most effective reorientation of their agriculture taking into account nutritional needs of their citizens, productive possibilities of their agriculture, and possibilities for development and expansion of their industries—such programs will have inevitable repercussions upon the exports of these countries and upon the imports of feed, food, or industrial supplies they will need. If the programs developed for a given country are not consistent with those developed by its customers and suppliers, they will not be fully workable. This interrelationship was recognized at Hot Springs, and the clear need for some method of international coordination and integration of the programs developed by individual countries was emphasized.

164. Resolution XV of the Hot Springs Conference suggested that the basis of this coordination should be periodic reports by Member governments to the permanent organization. In these reports the governments would summarize their progress in developing and implementing long-term production policies, and submit current facts on "production, exports, imports, and consumption of food and other agricultural and marine products." The Resolution also suggested that the permanent organization study "to what extent and by what means such reports might contribute to international collaboration both on a regional and a world basis in the field of agricultural production," particularly "with a view to balancing production and consumption."

165. It is clear that the collection of such reports from governments and their integration and analysis by FAO could not secure the results desired unless facts shown by that analysis are submitted to governments as the basis for further action by them. Such analysis might show, for example, that countries in need of high-protein concentrates for livestock feed were counting on importing larger quantities of such feedstuffs than exporting countries estimated they would have available for export. Or it might show that countries producing sugar or food grains for export were counting on export sale of larger

¹ Hot Springs Resolution XV, subsection 2 (c).

quantities than the importing countries needed. Or it might show that the supplies of imported fertilizers or farm machinery required by importing countries in a given year were larger or smaller than the quantities which exporting nations expected to have available for sale, after allowing for their own domestic requirements.

166. Hitherto, such gaps or inconsistencies have been adjusted more or less automatically by price movements, but in recent years these movements have often been so violent as to cause even more trouble than they cure. In the future, therefore, governments should consciously work out readjustments in their programs so as to make them mutually consistent and workable, without waiting for economic depressions or collapse. In the early postwar years, when the programs developed and submitted to FAO are likely to be only partial and incomplete, this analysis and mutual adjustment would necessarily be of a tentative and imperfect nature. As more and more countries develop and report specific programs of agricultural development, and as governments and FAO gain in experience in the ways of analyzing and integrating such programs and working out mutual readjustments to make them more effective, this process should become increasingly significant and helpful. After several years of such development, the objective set forth in Resolution XIV of the Hot Springs Conference of aiding nations to develop a real "long-term coordinated production plan for the best use of their resources on a world scale" should be realized.

SPECIAL INTERNATIONAL MEASURES FOR WIDER FOOD DISTRIBUTION

167. Analysis and integration of the agricultural and food programs of various countries may also provide suggestions for possible international steps toward wider food distribution. To use an example already cited, the summaries may show that certain regions of the world have supplies of food grains or of sugar available for export in considerably larger volume than the quantities importing countries expect to be able to purchase. At the same time reports from other countries may show heavy nutritive requirements for bulk carbohydrates, with no means in prospect for meeting these requirements either from their own production or from imports they are in a position to purchase, pending the successful completion of long-term plans for the development of their agriculture and industry. Such a situation would provide an excellent opportunity, as suggested at Hot Springs,¹ for producing and consuming countries to work together in studying "special international measures for wider food distribution... in connection with plans in the countries concerned for the long-term development of the national resources," and to work out "arrangements whereby a part of current world feed supplies would be used to supplement the national food-distribution programs of certain countries."

168. It is contrary to common sense to destroy food while people are starving, or to limit food production while large numbers of people are malnourished. At the same time it does no good to produce the food needed by people with low buying power unless some mechanism is provided for supplying the food to them. Creating arrangements for this purpose will involve great difficulties, yet surely mankind is

¹Hot Springs Resolution XXVII.

ingenious enough to find ways of solving them. This might be done as a part of general intergovernmental programs for encouraging and expanding international trade, or it might be done as a phase of the work on international arrangements for individual commodities. No matter how the supplies are provided, it would probably be necessary to ensure that where food supplies are made available to countries on special terms, or below the world market level of prices, they will be used solely to expand consumption among malnourished groups in the country concerned, and under such conditions that they will not compete with or replace the regular commercial movement. Any arrangements of this sort worked out would also need to provide ways in which the costs would be covered.

INTERNATIONAL ARRANGEMENTS AND REORIENTATION

169. The process of integrating the reports of the various governments into a consistent and effective long-term world program might be assisted by cooperation between FAO and any special or general commodity authorities that may be established to administer commodity arrangements.¹ Where such commodity arrangements exist or are established, they may also serve as a convenient means of implementing the decisions of governments as expressed in the integrated long-term agricultural program. Such commodity arrangements would also be important as means for negotiating and for carrying through any special international measures for wider food distribution such as those suggested in the preceding paragraphs.

170. International commodity arrangements in the inter-war period tended to be oriented more toward reduced volume than toward an expanding economy. Since such agreements were generally initiated at times of very low prices and great pressure of supplies, their first provisions in seeking to restore balance were generally of a restrictive nature although it is doubtful that their effects were as restrictive as the operations of industrialists during the same period.

171. This restrictive tendency, moreover, is not a necessary characteristic of international commodity arrangements. As already suggested, they could be used as a mechanism for expanding the supplies of particular commodities in an orderly way, keeping those expanding supplies in balance with the concurrent expansions in demand. At the same time they might provide means to readjust sources of supply so as gradually to shift production to the areas where the product could be produced to the greatest advantage, as called for at Hot Springs.² When changes in production seem necessary, either up or down, the action taken should be in accord with this principle. If prospective demands should exceed production, an effort should be made to reach agreement among countries to make the largest increases in output in the areas where the particular product can be produced most efficiently. When it is found that consumption (including low-income consumption stimulated by special measures) is falling short of production, efforts should be made to reach agreement on ways to adjust output. These might include arrangements for the areas least

¹Hot Springs Resolution XXV. See also United Nations Interim Commission on Food and Agriculture, *First Report to the Governments of the United Nations by the Interim Commission on Food and Agriculture*, Washington, August 1, 1944, paragraphs 70-73 and 80-81.

²Hot Springs Resolution XV, section 2(c).

efficient in the production of that product to shift part of their resources from it to other products better suited to the area and for which demands are larger.

172. Carrying through reorientation measures in individual countries and arrangements with respect to given commodities may involve new requirements for agricultural credit—for individual farmers* for production purposes, for marketing agencies or facilities, or even for associated developmental or industrialization projects. Problems involved in such provision of credit have been referred to in a previous section of this report.

NONCOMMERCIAL AREAS

173. Millions of the world's farmers, including some even in such developed countries as Canada and the United States, produce mainly for their own families and sell very little. They are scarcely affected by the ups and downs of commodity markets and the vagaries of international trade. For them the measures discussed in this section of the report appear to have no particular significance. Yet indirectly there is a relationship, for unless through reorientation and coordination the wider problems of prices and markets can be harmoniously resolved, general economic activity cannot flourish nor can governments devote themselves energetically to those programs of rural betterment which would bring a real benefit to these people.

174. Meantime direct measures for improving the welfare and nutrition of such farmers and their families should include, first, programs to increase the quantity and nutritive value of the food they produce for their own direct consumption and, second, efforts to provide opportunities for related part-time employment to supplement their agricultural production. Fur production, fishing, and lumbering are all examples of occupations that have seasonal labor requirements fitting in well with those for subsistence agriculture. Some combination of farming with such occupations, along with improvements in agriculture itself, may be the most feasible program in many regions of the world. In planning programs for the development of such areas, special attention should be given to those aspects which will aid noncommercial farmers.

Recommendations

175. The Committee recommends that :

(1) FAO should prepare itself to furnish information and advice on the many technical problems that invariably arise in any change-over from monoculture to diversified farming, or from a high-cost artificially supported production to other kinds better suited to the area.

(2) As many of these questions relate to a whole region rather than a single country, FAO should collaborate not only with individual countries, but also with regional organizations (such as those already developed or being developed for the Middle East and Caribbean areas) in the consideration of reorientation possibilities.

(3) FAO should prepare periodic reports of the prospective world pattern of production, consumption, and international

trade in the major agricultural products, as contrasted to world needs for improved nutrition in view of consumption goals as set by the authorities of each country. Individual governments could more satisfactorily formulate their own agricultural policies in the light of these reports.

(4) FAO should arrange from time to time for a series of discussions with governments, regionally and world-wide, to consider its reports of world conditions, and to develop appropriate recommendations for the consideration of governments. Officials of the appropriate international agencies dealing with commodity arrangements should participate in these discussions.

(5) FAO should be prepared to aid governments to develop international arrangements for individual commodities or groups of commodities which will serve to fit the plans for the production, exchange, and consumption of the major products important in international trade into the larger framework of a general program for world agriculture as a whole, expanding yet balanced between its various parts.

(6) FAO should aid and encourage international commodity agencies to work out special arrangements by which surplus commodities may be supplied on specially advantageous terms to countries of low purchasing power and great nutritional need, for special distribution among their low-income and disadvantaged groups.

(7) FAO should do all it can to see that measures for the reduction or restriction of production, where found necessary, are accompanied by appropriate arrangements for the productive use of the displaced resources and people.

(8) FAO should establish and maintain close working relations with related international institutions, in order that all possible alternative uses may be provided for any excess capacity in agriculture, and that the agricultural phases of development programs be properly integrated with other phases. In addition, since agricultural reorientation programs frequently involve new installations, such as irrigation facilities, food processing plants, and new railways, which in many cases can be provided only through international loans, FAO should be prepared to act in a liaison or consultative capacity in negotiations between governments and the projected international bank.

PART III. IMMEDIATE ACTIVITIES RECOMMENDED

176. FAO cannot be expected to undertake in its first year the comprehensive program of work outlined in the preceding pages. With its limited staff and funds—only part of which, of course, can be devoted to the problems of agricultural production—it will need to select at the outset those activities which are most urgent.

177. This selection could be made with assurance, however, only after the many problems ahead had been viewed in their entirety. For this reason the Technical Committee on Agricultural Production has reported at length. It has recommended activities in several broad fields and has outlined in each a number of highly specialized projects which will take years—or even decades—to complete. It has prefaced its recommendations with a summary of the conditions, now existing or in prospect after the war in various countries, which make collaborative activity under the leadership of FAO advisable. More than that, it has introduced the entire report with a careful review of economic and social conditions in agriculture during the war and inter-war years. It was in these years that many current problems had their origin. Understanding the circumstances under which they arose should aid in solving them in the years ahead.

178. There remains the immediate problem of where to start. What phases of work in agricultural production should be singled out for immediate attention? This initial work should be directed on the one hand to improving farm production methods and increasing food output, especially in the less advanced countries, and on the other to aiding the nations engaged in commercial agriculture to integrate and harmonize their agricultural programs.

Recommendations

179. The Committee recommends that in so far as possible the following activities be started as soon as FAO is established:

(1) **Missions to less advanced countries.** Many of the projects recommended in the preceding pages can be successfully undertaken only by people with expert knowledge and with experience acquired in other projects of a similar nature. Consultation on the spot between qualified experts representing FAO and officials of the interested countries is essential. Many missions on many agricultural problems undoubtedly will be requested of FAO by various countries, but in the first year it may be necessary to concentrate on (a) missions to help expand extension work, and (b) missions to help expand the production of protective foods. The returns from both of these are immediate and involve basic functions of FAO. It is to be hoped that a number of such missions will be organized and begin their work within the first year of FAO's existence, and

will carry their work far enough to enable FAO to submit at least preliminary reports of findings to the governments of the countries requesting such help.

(2) **Immediate technical improvements.** In many countries, especially underdeveloped ones, very rapid advances in agricultural production could be brought about by the adoption of simple technical improvements that are already available.¹ The problem is largely one of directing attention to these improvements and the ease with which they may be adopted, and of encouraging and facilitating their widespread use. Obviously, aiding countries in such developments is a primary function of FAO which should be undertaken as soon as possible.

(3) **Work on commodity situations and production programs.** In the first year FAO should make the best possible appraisal of the prospective production, exports, imports, and consumption of major commodities in all countries. It will be important also to begin work on the collection and improvement of statistics, as recommended in the companion report on statistics, and to initiate a system of regular reports by governments to FAO.

By starting this work at the same time that FAO missions are assisting interested countries, FAO will be in a position to advise governments on the integration of their programs even while the governments are working out solutions to the most pressing technological problems involved in raising levels of food production and consumption in their respective countries.

(4) **Collaboration with the United Nations Relief and Rehabilitation Administration.** The work in agricultural production that UNRRA is undertaking as part of its program of relief and rehabilitation is necessarily temporary and quite limited in scope. This work may, however, influence for some time to come the progress of reconstruction in these countries.

It is to be hoped that the policies followed should be such as will make it easy, when UNRRA's work is finished, for FAO to carry on whatever continuing international agricultural functions UNRRA will have begun. It seems advisable, therefore, that the working relationships already discussed between UNRRA and the Interim Commission be continued and extended.

180. In conclusion it should be emphasized that the answer to how FAO can best develop its work can be determined only by the trial and error of actual operating experience. In the meetings of FAO's Conference, the activities of its staff, and the actions of its panels and missions, this problem will be resolved. Out of many interchanges with Member governments, regional organizations, and other international agencies, a pattern of effective cooperative working relationships should evolve.

181. It is impossible to forecast the precise lines this evolution will take, or the demarcation between the work and responsibilities of individual governments and of international bodies that will be found most useful and effective. Experience and practice will determine how far FAO will work solely through governments, and how far it can usefully work with officials of educational or scientific institutions or of private organizations.

APPENDICES

I. SPECIAL PROJECTS OF IMMEDIATE VALUE

1. Much of the work of FAO will necessarily involve long-term studies, from which results cannot be expected for several years. Meanwhile a good deal can be done to improve production in various countries by simple and relatively obvious means, requiring little in the way of elaborate preparation. In consultation with governments FAO should actively seek ways in which it might be useful in helping to discover and develop such opportunities, especially during its first few years of existence. Even relatively small improvements, where the levels of production and consumption are very low, can be of great significance to many people; and they will have the added value of arousing interest and maintaining public confidence in the work of FAO.

2. Most such projects involve not so much new research as the application, where it has not been used before, of knowledge that has been applied successfully elsewhere. FAO will mobilize for every country the best brains and experience of all countries; that is the purpose of its expert staff, its committees, its missions, its cooperative studies. With such rich resources of experience and knowledge to draw on, it will be strange if many things of a practical nature cannot be done even in the early stages of the development of FAO.

3. Even in the most highly developed countries, agricultural experts know that many things could be done that would bring about significant, and often relatively rapid, improvements in the production or distribution of one or more important products. In countries where relatively little has been done to apply science in agriculture, such possibilities for improvement are legion, and the need to develop them is correspondingly urgent. The problem is one mainly of recognizing the need, arousing interest, and taking vigorous public action. In selecting projects to emphasize, it would be necessary to make a judicious choice based on the urgency of the need and the probability of practical results.

4. Obviously, no specific suggestions for such projects can be made at this stage; they must emerge from inquiry and consultation after FAO comes into existence. The following brief list gives a few examples of the possibilities that might be explored:

(1) Poultry improvement, as is suggested elsewhere in this report, offers a ready means of adding to farm production and farm income and of improving the nutrition of farm people in many places and with relatively slight expense.

(2) Control of insects, in some cases, would do more than any other one thing to increase the supply of major food products. Advances made in insect control methods during the war offer great promise in this field. New insecticides and new methods of

dispersing insecticides, including improved airplane dispersal, should be studied from the standpoint of securing rapid and wide-spread use.

(3) Better control of plant diseases is an equally urgent need in many places. In others, control of certain animal diseases is the most important problem. Outbreaks of disease sometimes decimate flocks or herds, and nothing effective is done to prevent them. Although control of most animal diseases may involve extensive long-term educational, sanitary, and veterinary work, a few diseases may be controlled quickly and at low cost by the use of vaccines or antitoxins.

(4) Native sources of feedstuffs for livestock and poultry can sometimes be developed by intensive effort. For example, a wide range of products is now known to be suitable for ensiling as cattle feed; simple pit soils can be used where more elaborate structures are not available. The seeds of wild plants, abundant in some areas, might make good poultry feed. Practices for improving pastures have recently been developed in some countries; these practices might be used in areas of similar climate elsewhere.

(5) In some countries with many milk cows little use has been made of improved dairy practices, such as feeding rations of the proper composition, or culling low-producing cows. Intensive efforts to get such practices of demonstrated effectiveness put into use might result in rapid improvement in the quantity and efficiency of milk production.

(6) More fruits and vegetables than are now produced can be grown in many countries. Some tropical areas that do not have a year-round fruit supply could readily produce it. Certain wild fruits have been found to be abundant and readily usable sources of vitamin C where citrus fruits are not available. New methods of food preservation, especially for fruits and vegetables, may be applicable in many areas, and their use might raise levels of nutrition between harvest periods.

(7) The introduction of well-known farm machinery or other modern equipment, or even improved hand tools such as wheel hoes, is sometimes the first need. Fertilizers are needed for improving production in certain areas where major deficiencies are already known.

(8) Production could be materially increased by the use of improved or acclimatized varieties of seeds in some regions, and in other regions by specific cultural practices such as summer-fallowing semiarid lands between crops. Where the value of such practices has been determined, steps should be taken to get these innovations rapidly adopted.

II. COMPOSITION AND WORK OF THE TECHNICAL COMMITTEE ON AGRICULTURAL PRODUCTION

1. In April 1944, Committee "C" of the United Nations Interim Commission on Food and Agriculture established among a number of other committees a Technical Committee on Agricultural Production. Its first chairman was Professor Scott Watson who, on his departure

from Washington, was succeeded by Mr. L.A.H. Peters. The following have served as members of the Technical Committee:

Monir Bahgat (Egypt), Agricultural Attaché, Royal Egyptian Legation, Washington

Mordecai Ezekiel (U. S. A.), *Rapporteur*; Economic Adviser, Bureau of Agricultural Economics, Department of Agriculture, Washington

W. J. Green (UNRRA), Chief, Coordination and Field Staff Section, Agricultural Rehabilitation Division, Washington

Darwish Haidari (Iraq), Chairman of Committee "C", United Nations Interim Commission; Director of the Central Agricultural Experiment Station, Baghdad

Gove Hambidge (U. S. A.), Coordinator of Research Publication, Agricultural Research Administration, Department of Agriculture, Washington

Einar Jensen (United Nations Interim Commission on Food and Agriculture), member of staff, Washington

Lidia A. Koretskaya (U. S. S. R.), Assistant Professor, Moscow Agricultural Academy, Moscow

Frank L. McDougall (Australia), Economic Adviser to the High Commissioner of Australia, London

André Mayer (France), Professor and Vice President, Collège de France, Paris

Václav Myslivec (Czechoslovakia), Professor, Czech Technical University, Masaryk Academy and Czechoslovak Agricultural Academy, Prague

A. I. Nikolaev (U. S. S. R.), Professor, Moscow Agricultural Academy, Moscow

Mukdim Osmay (I. L. O.), Chief, Agricultural Service, Montreal

L. A. H. Peters (Netherlands), *Chairman*; Agricultural Attaché, Netherlands Embassy, Washington

Robert Rae (U. K.), Professor of Agriculture, University of Reading, Reading

J. A. Scott Watson (U. K.), former *Chairman*; Professor of Rural Economy, Oxford University, Oxford

Hazel K. Stiebeling (U. S. A.), Chief, Bureau of Human Nutrition and Home Economics, Department of Agriculture, Washington

Howard R. Tolley (U. S. A.), Chief, Bureau of Agricultural Economics, Department of Agriculture, Washington

P. W. Tsou (China), President, Agricultural Association of China, Chungking; Vice Chairman, United Nations Interim Commission on Food and Agriculture, Washington

Leslie A. Wheeler (U. S. A.), Chief, Office of Foreign Agricultural Relations, Department of Agriculture, Washington

P. Lamartine Yates (U. K.), Ministry of Agriculture, London

2. The scope of work included a survey of world agricultural production trends and potentialities as shown by developments in the inter-war period, a consideration of the lessons to be learned from the technical and administrative experience of the war years and of present ideas on postwar plans, and finally recommendations as to the services which FAO might most usefully render.

3. The work was developed in three

series of country reports, (2) consideration of general improvement problems, (3) a special review of production possibilities for certain protective foods.

4. Country reports were prepared by members or collaborators for many countries, covering for each country the national experience in agricultural production during the inter-war and war periods, and the recent thought on postwar policies. These were personal expressions of opinion and do not necessarily represent official governmental views. In addition, memoranda were prepared on a number of special topics.¹

5. Attention was also given to certain general agricultural problems which arise in many countries, for example, soil conservation, irrigation, plant breeding, livestock improvement, veterinary services, and development in farm machinery. Special memoranda were prepared on a number of such points. A beginning was made in compiling a comprehensive list of wartime developments in the various fields of agricultural science.

6. In addition to the long-term expansion of agricultural production, the possibilities of obtaining a more immediate increase in the output of certain protective foods were explored. Two special panels were set up, one on dairying and one on poultry keeping. They prepared the reports on dairying and poultry, which have been referred to and summarized in the body of this report.

7. The facts of war experience to date are fully known for only a few countries, and the war is not yet over. For large and populous regions of the world even the prewar situation is only roughly measurable. Many points will remain uncertain or unknown until they are cleared up by future information or research. Efforts were made to secure the help of experts from as many countries and regions as possible. Those who could participate were necessarily limited to persons from some of the United Nations. For the neutral and enemy countries, and even for large areas of Asia, Africa, and South America, the information had to be drawn from available reports and from observations made by trained technicians from other countries during visits there. All of these conditions have made the committee's report necessarily tentative in character, and subject to future reconsideration, revision, or extension.

III. SUPPORTING DOCUMENTATION

1. In general, the supplementary mimeographed reports prepared by the Technical Committee on Agricultural Production of the Interim Commission fall into three broad categories: (1) those on various phases of agricultural production in different countries or regions, (2) those dealing specifically with dairying in different countries or regions, and (3) those relating to special topics but not classified by country or region. In the following list the classifications used are the Committee's code numbers by which the documents are filed in the Registry of the Interim Commission.

GENERAL REPORTS BY COUNTRIES OR REGIONS

- DRAFT MEMORANDUM ON AGRICULTURE IN AUSTRALIA, July 29, 1944,
Misc. 11, 9 pp.
- DRAFT MEMORANDUM ON AGRICULTURE IN CANADA, October 20, 1944,
Misc. 18, 14 pp.
- MEMORANDUM ON AGRICULTURE IN THE CARIBBEAN, November 1, 1944,
Misc. 19, 14 pp.
- REPORT OF THE POST-WAR AGRICULTURAL COMMISSION [Chile], March
10, 1944, Misc. 2, 17 pp.
- MEMORANDUM ON CZECHOSLOVAK AGRICULTURE, June, 1944, Misc. 8,
39 + 2 pp.
- DRAFT MEMORANDUM ON DANISH AGRICULTURE, September 26, 1944,
Misc. 16, 17 pp.
- DRAFT MEMORANDUM ON FRENCH AGRICULTURE, June 21, 1944, Misc.
6, 19 pp.
- DRAFT MEMORANDUM ON INDIAN AGRICULTURE, September 6, 1944,
Misc. 14, 14 pp.
- DRAFT MEMORANDUM ON AGRICULTURE IN IRAQ, October 19, 1944, Misc.
17, 10 pp.
- DRAFT MEMORANDUM ON AGRICULTURE IN THE NETHERLANDS, June 16,
1944, Misc. 5, 23 pp.
- NOTES ON SUBSISTENCE FARMING IN NEWFOUNDLAND, November 24,
1944, Misc. 21, 6 pp.
- AGRICULTURE IN THE DOMINION OF NEW ZEALAND, August 8, 1944,
Misc. 13, 7 pp.
- DRAFT MEMORANDUM ON SWEDISH AGRICULTURE, January 2, 1945,
Misc. 24, 16 pp.
- DRAFT MEMORANDUM ON AGRICULTURE IN THE UNITED KINGDOM, May
13, 1944, Misc. 4, 16 pp.
- DRAFT MEMORANDUM ON AGRICULTURAL POLICIES IN THE UNITED STATES
SINCE WORLD WAR I, July 29, 1944, Misc. 12, 15 pp.

DAIRY REPORTS BY COUNTRIES OR REGIONS

- FUTURE OF MILK PRODUCTION IN DENMARK, October 16, 1944, DAIRY
Doc. 19, 12 pp.
- DRAFT MEMORANDUM ON DAIRYING AND DAIRYING CONDITIONS IN IRAQ,
JULY 14, 1944, DAIRY Doc. 11, 6 pp.
- THE POTENTIAL FEED PRODUCTION OF THE PERMANENT PASTURE IN THE
NETHERLANDS, June 30, 1944, Dairy Doc. 9, 11 pp.
- DRAFT REPORT ON DAIRYING IN NORTH WESTERN EUROPE, August 23,
1944, Dairy Doc. 14, 20 pp.
- THE FUTURE OF DAIRY PRODUCTION IN THE MEDITERRANEAN BASIN,
September 4, 1944, Dairy Doc. 17, 9+2 pp.
- IMPROVEMENT OF DAIRYING IN SOUTHEASTERN ASIA, August 9, 1944,
Dairy Doc. 13, 6 pp.

[United Kingdom] FUTURE OF MILK PRODUCTION IN BRITAIN, May 15, 1944, Dairy Doc. 4, 14 pp.

DAIRY DEVELOPMENT IN THE SOUTHERN REGION OF THE UNITED STATES, June 1, 1944, Dairy Doc. 7, 8 pp.

REPORTS BY SPECIAL TOPICS

POSSIBLE POST-WAR MEASURES TO AID THE RESTORATION AND EXPANSION OF DAIRY PRODUCTION, May 1, 1944, Dairy Doc. 1, 5 pp.

FORAGE FOR DAIRY CATTLE, May 1, 1944, Dairy Doc. 2, 2 pp.

DAIRY AFTER THE WAR, May 1, 1944, Dairy Doc. 3, 4 pp.

SCIENTIFIC DEVELOPMENTS USEFUL IN MAINTAINING OR INCREASING PRODUCTION AND SCIENCE IN AGRICULTURAL PRODUCTION, May 1, 1944, Misc. 3, 14 pp.

SCOPE OF WORK FOR PANEL SUBCOMMITTEE ON AGRICULTURAL PRODUCTION, May 3, 1944, Doc. 3, 2 pp.

DAIRY CATTLE BREEDING IN THE TROPICAL AND SUB-TROPICAL AREAS, May 15, 1944, Dairy Doc. 5, 15 pp.

MEMORANDUM FOR PANEL SUBCOMMITTEE ON AGRICULTURAL PRODUCTION —DAIRY—OF THE UNITED NATIONS INTERIM COMMISSION ON FOOD AND AGRICULTURE, June 3, 1944, Dairy Doc. 6, 2 pp.

UTILIZATION OF UREA IN AGRICULTURE, June 21, 1944, Dairy Doc. 8, 3 pp.

MEMORANDUM ON THE PROSPECTIVE WORLD FATS AND OILS SITUATION, July 1, 1944, Misc. 7, 2 pp.

SYNTHETIC UREA PROVES SATISFACTORY FOR DAIRY RATIONS, July 1, 1944, Dairy Doc. 10, 3 pp.

THE PLACE OF FATS IN THE DIET, July 27, 1944, Misc. 9, 2 pp.

POSTWAR DEVELOPMENT OF THE DAIRY INDUSTRY, August 8, 1944, Dairy Doc. 12, 5 pp.

DAIRY PROGRAM FOR FAO, September 19, 1944, Dairy Doc. 16, 39 + 2 pp.

REPORT TO PANEL SUBCOMMITTEE ON AGRICULTURAL PRODUCTION FROM THE DAIRY GROUP, October 20, 1944, Dairy Doc. 20, 49 pp.

REPORT TO TECHNICAL COMMITTEE ON AGRICULTURAL PRODUCTION FROM THE POULTRY GROUP, November 24, 1944, Doc. 7, 6 pp.

FISHERIES

**Report of the Technical Committee
on Fisheries, submitted to the United
Nations Interim Commission on Food
and Agriculture**

April 13, 1945

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PART I. CONSUMPTION

1. From ancient times man has recognized the food value of fish. The search for fish has been an important factor in governing his migrations and has had its influence upon his social structure. It is reasonable, therefore, that fish should be regarded as one of the more important sources of food in any program for raising the nutritional levels of peoples throughout the world.

2. Nutritional research has established beyond any doubt the high value of fish proteins in the diet of man and domestic animals. The muscle tissue of fish is of delicate structure and is easily digested. Sea fish contain a desirable balance of the trace elements which are found in sea water. These include iodine, copper, manganese, iron, and other minerals which have been shown to be essential to good health. As a class, fish—particularly shellfish—contain more generous supplies of calcium than the average food derived from the land. Fish livers constitute an excellent source of vitamins A and D, the importance of which need not be stressed. Because of their iodine content, sea fish have proven useful in controlling endemic goiter.

3. Measured by the labor involved, fish are among the least costly of all protein foods; there are no fields to plow and cultivate, no seeds to sow, and no stock to tend in order to reap a bountiful harvest.

4. In the United States, the National Research Council has estimated production figures for the lowest priced protein food produced on farms, i.e., pigs fed on corn grown on the farm. These figures show that the product of one man-year effort on a fertile midwestern farm is about 32,600 pounds of edible pork and fat.

5. Similar estimates made by the United States fishery industry offer an interesting comparison. One United States trawler with twenty men produces 1,600 million pounds of edible portion of fish, largely cod and haddock, or 80,000 pounds per man per annum. If the man-years required to build the ship and to depreciate it over a period of twenty years are included, four more men should be added to this calculation. Therefore, in the cod fishery, one man+ship-year would produce 66,400 pounds of edible portion of fish, or more than twice the production of pork and fat. In the California sardine fishery, one man+ship-year produces 200,000 pounds of edible portions of fish, which is about six times the productivity of the corn-pork combination.

6. It may be assumed that although pork has a somewhat higher caloric content, the food value of fish, including its by-products liver oil and fish meal, is comparable with that of pigs if due consideration is given to minerals, trace elements, and vitamins.

7. Similar calculations would probably reveal that other great fisheries, such as the sea herring, salmon, halibut, and shrimp fisheries, are equally efficient in terms of food value and human effort.

8. World production of fish has been estimated at about 39,000 million pounds annually, approximately two thirds of which is available

for human consumption. The remainder is manufactured directly from the raw product into such industrial products as fish meal and oil. Of the total amount marketed for human consumption, roughly 40 percent or 10,400 million pounds is edible. Assuming a world population of some 2,200 million people, the average annual per caput consumption is roughly 5 pounds. This figure is misleading, however. In order to obtain a clear picture of fish consumption, distribution must be considered. Consumption among the maritime populations near the great fisheries is very much higher than among peoples who live far from the sea. The average annual per caput consumption of fish and fishery products in various countries has been computed from time to time, but the bases of calculation are too variable to permit a comparison of the data for one country with those of another. Accurate comparison must await the preparation of more complete and standardized international fishery statistics.

9. The present uneven distribution of fish may quite conceivably be bettered through the application of inexpensive methods of preservation. Improved technical methods should assist in the transportation inland of this protein food where it would supplement the diets of undernourished persons. Toward the same end, fish-cultural methods may further the establishment of new fresh-water fisheries and the exploitation of those already functioning.

10. As in the case of other foods, tradition and prejudice can greatly influence the marketing of fishery products. Religious customs, entirely unconnected with the abundance or scarcity of supply, often affect the whole fishery economy. Fish that are considered to be an important food in one locality are sometimes regarded as inedible or even poisonous in another part of the world. For instance, while many Americans have an aversion to eating eel, smoked eel is considered a delicacy in Scandinavian countries. On the other hand, the average Scandinavian would shrink from eating clams, which are available to him, or squid, which is considered highly palatable by peoples in the Mediterranean countries. In many countries shark meat is believed to be inedible, yet the Chinese pay high prices for the fins of certain species of sharks. Such prejudices create waste. Large parts of the catches are sometimes dumped back into the sea because they consist of fish which, in the belief of the local fisherman, are unfit for human consumption. Yet there may be heavy demand for these types of fish in another part of the world. Conditions like these call for an educational program to overcome prejudice and create a demand for the enormous variety of sea food that is now going to waste.

PART II PRODUCTION

1. FISHING AREAS

11. Contrary to popular belief, the sea is not "full of fish." Temperature of the sea, depth of water, and currents are the primary limiting factors in the geographical range of fishes and other forms of marine life. Tropical zones are characterized by a greater diversity of species than temperate, polar, or subpolar zones, but each species is present in far less abundance. Temperate zones have fewer species of fish, and the polar and subpolar zones still less, than the tropical zones, but the species are present in far greater numbers. Apart from zonal relationships, the abundance of individual kinds of marine life is definitely related to the continental shelf. This shelf is a subsurface plateau which varies greatly in width in different regions and surrounds all continents or great land masses. It is formed either by erosion of the land by waves, or by rivers carrying mud or silt from the land into the sea. The shelf slopes gradually downward, its outer edge being about 200 fathoms (1,200 feet) below the surface. Beyond its edge the sea deepens rapidly into the abyssal regions where life is rare. Fishes and other marine animals are most abundant on its inner portion, where the fertility of the bottom and the other elements of sunlight and currents are conducive to the production of food organisms and provide favorable conditions for reproduction and growth. The broad expanse of the continental shelf in the North Atlantic Ocean and the North Sea, and the consequent tremendous abundance of a comparatively small number of individual species, have been responsible for the development of large fishery industries.

12. The anadromous species (those entering fresh water to spawn), such as the Pacific salmons, support great fisheries for an additional reason. The adult populations annually leave their broadly dispersed feeding grounds at sea, and in vast migrating schools move shoreward and upstream to their spawning grounds in coastal rivers. Fishermen intercepting the spawning runs are able to make large catches in a short time.

13. In contrast to the North Atlantic and the North Sea with their prolific resources are areas such as the central regions and the outer islands of the Caribbean area where the continental shelf is extremely narrow and the very diversely constituted fish and shellfish faunas are available only in small quantities, and only seasonally.

14. The great fisheries of the world have been developed primarily by the maritime nations of the Northern Hemisphere and the abundant resources have been fished with great intensity. In many areas overfishing has occurred. Other areas in the world contain substantial fishery resources that are underdeveloped; many potentially profitable supplies are totally unused by man. Opportunities for expansion of fishery industries, for example, exist in South America, Asia, and Africa; the resultant production would improve the diet and yield fishery commodities such as vitamin oils.

15. Areas of major fishery resources of the world are as follows :

North America

Atlantic : Waters contiguous to South Greenland, Labrador, Newfoundland, the Maritime Provinces and other parts of Canada, the Atlantic coast of the United States ; and the areas covered by Davis Strait, the Grand Banks, and the Gulf of Mexico.

Pacific : Waters contiguous to Panama ; the areas covered by the Bering Sea and from the Gulf of Alaska to Lower California ; and offshore Central America.

South America

Atlantic : Waters contiguous to Venezuela, the Guianas, Southern Brazil, Uruguay, Argentina, Falkland Islands, and Tierra del Fuego.

Pacific : Waters contiguous to Peru, Chile, and the Galapagos Islands.

Asia

Waters contiguous to the Siberian coast and the East Indies ; and the areas covered by the Bering, Okhotsk, Caspian, Japan, and China seas, and the Bay of Bengal.

Africa

Waters contiguous to the Atlantic coast of South Africa and Angola ; and the areas covered by the Gulf of Guinea, the waters in the region of the Cape Verde and Canary Islands, and the Mediterranean.

Europe

Waters contiguous to the coast of Norway, the Faroes, Shetlands, and Orkneys, Iceland, Jan Mayen, and Bear Island ; and the areas covered by the Bay of Biscay, and the North, Baltic, Barents, Kara, and Black seas.

Australia, New Zealand, East Indies

Waters contiguous to the central and southern New Zealand coasts, Tasmania, and the southern and eastern Australian coasts.

16. As has already been pointed out, some of these areas are fished with great intensity, while others are fished to a lesser degree until such a time as improved fishing techniques and processing and distribution methods are put into use and profitable markets for the catch are found.

2. PRODUCTION OF THE RAW MATERIAL

BY COUNTRIES

17. In representative prewar years the estimated production of the commercial fisheries of the world, excluding whale products, was about 37,000 million pounds. To this must be added 2,000 million pounds as a gross estimate of the amount yielded by subsistence fishing, angling, and unrecorded commercial production. The production by principal countries, oceans, and hemispheres is shown in the follow-

ing graphs and table. Detailed information taken from the same source¹ will be found in Appendix I.

18. In Figure 1 it can be seen that there is a wide variation in the annual production of fish by countries. Japan, with a production of 8,000 million pounds, produces twice as much as the United States and Alaska which together secure 4,000 million pounds. Japan, the United States and Alaska, Russia, and China, are, between them, responsible for about half of the world's production.

19. While, from the standpoint of consumption, production figures are significant, they alone are not a reliable guide to the relative importance of fishing in the total economy of a country. Table 1, by furnishing a measure of total national energy going into fishing, to some degree illustrates this point.

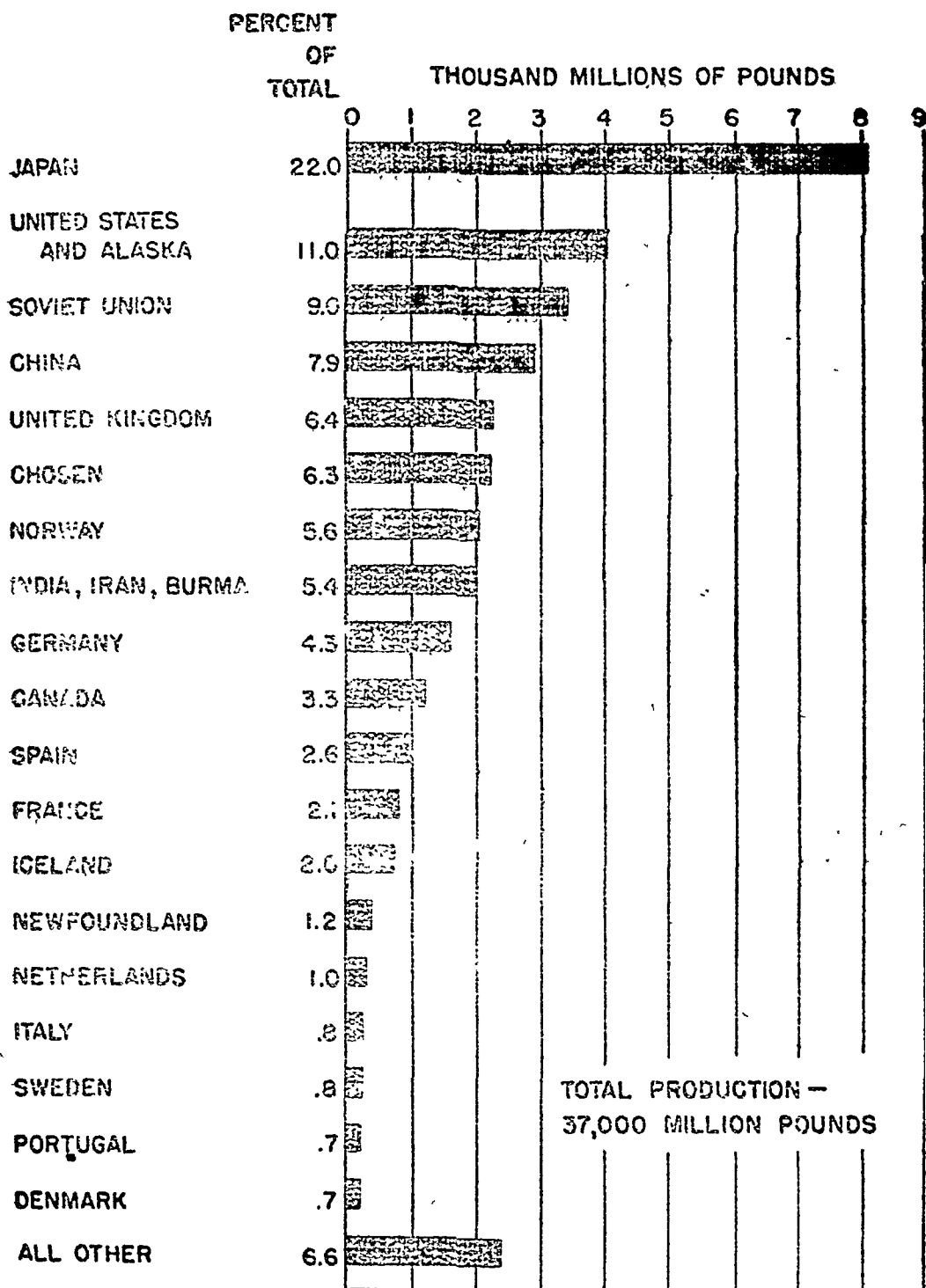
20. Figures 2, 3, and 4 reveal that fishing is overwhelmingly a northern hemispheric activity. The North Atlantic and the North Pacific yield 94 percent of the world catch, and Asia, with its vast coastline, is responsible for about half of the world's production.

BY SPECIES

21. Figures on the world production of fish according to species are not available. It can be said, however, that the principal sea fisheries of the world are based on such demersal species (bottom-dwelling forms) as cod, haddock, hake, cusk, and pollock—known in some countries as "white fish" and in others as "groundfish"—and on such pelagic (surface) species as sea herring, pilchard, sprat, anchovies, and menhaden (a herring-like species). Some members of these two groups are found, in varying concentrations, throughout the fishing areas of the world. On the Grand Banks alone in the western North Atlantic, in normal times, about 1,000 million pounds of cod are taken annually by fishing vessels from Canada, France, Italy, Newfoundland, Portugal, and Spain. Another large group of pelagic species includes the tunas and tuna-like fishes and the mackerels of various kinds. A fourth group includes such anadromous species as salmon, smelt, and shad.

¹ U. S. Department of the Interior, Fish and Wildlife Service. *Fishery Market News*, Washington, July, 1944.

FIGURE 1
**WORLD COMMERCIAL FISHERY PRODUCTION
 BY COUNTRIES**



SOURCE: U.S. FISH AND WILDLIFE SERVICE

FIGURE 2

WORLD FISHERY PRODUCTION BY WATERS

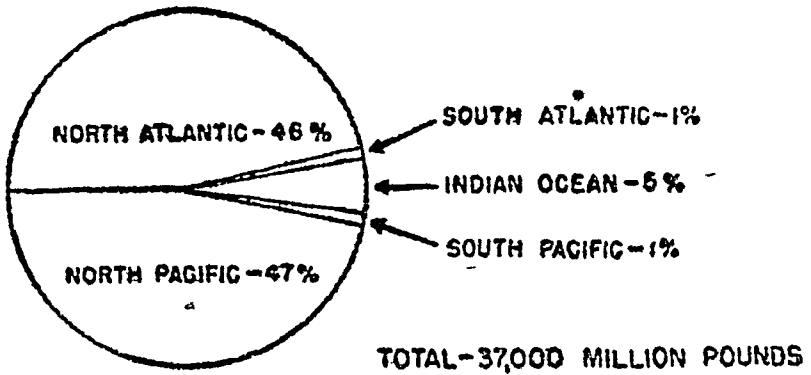


FIGURE 3

WORLD FISHERY PRODUCTION BY HEMISPHERES

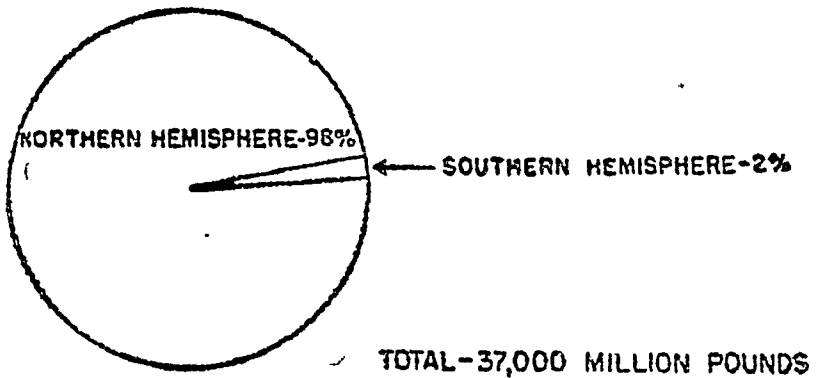
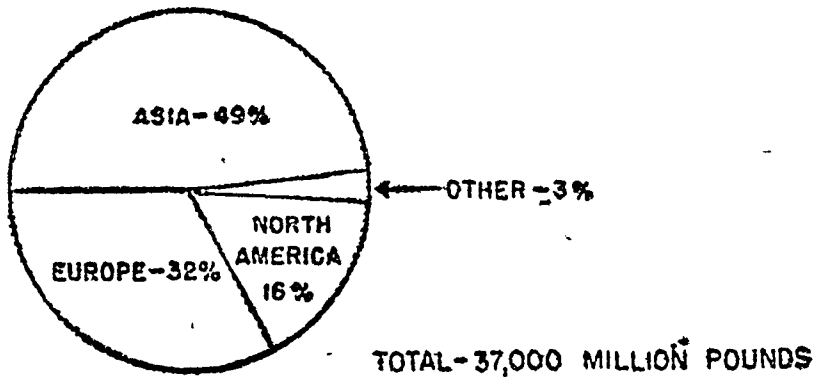


FIGURE 4

WORLD FISHERY PRODUCTION BY CONTINENTS



SOURCE: U. S. FISH AND WILDLIFE SERVICE

TABLE 1. PRODUCTION PER CAPUT IN VARIOUS COUNTRIES

Country							Per caput production (Pounds)
Iceland...	...	...	...	...	...	...	6,223
Newfoundland	...	...	...	...	...	...	1,525
Norway	...	...	...	...	...	...	680
Japan	...	...	...	...	...	...	111
Canada	...	...	...	...	...	...	109
Chosen	...	...	...	...	...	...	160
Kwantung Leased Territory	...	...	...	...	...	...	67
Denmark	...	...	...	...	...	...	63
Sweden	...	...	...	...	...	...	49
United Kingdom	...	...	...	...	...	...	48
British Malaya	...	...	...	...	...	...	39
Netherlands	...	...	...	...	...	...	39
Portugal	...	...	...	...	...	...	37
Spain	...	...	...	...	...	...	37
United States and Alaska	...	...	...	...	...	...	35
Venezuela	...	...	...	...	...	...	33
Germany	...	...	...	...	...	...	20
France	...	...	...	...	...	...	20
Soviet Union	...	...	...	...	...	...	18
Philippine Islands	...	...	...	...	...	...	11
Argentina	...	...	...	...	...	...	9
Mexico	...	...	...	...	...	...	8
Italy...	...	...	...	...	...	...	7
China	...	...	...	...	...	...	6
India, Iran, Burma	...	...	...	...	...	...	5
Brazil	...	...	...	...	...	...	3

22. Throughout the world wherever these species or groups of species are found they form the basis of the trade in fresh fish and fish salting, canning, and freezing industries, and the products therefrom are usually the basis of international trade in fishery products.

FRESH-WATER FISHERIES

23. In the foregoing, attention has been directed primarily to the sea fisheries, but the world also has important fresh-water fisheries. Few figures are available on the production of these fisheries, but in several countries it forms an important source of animal protein food. For instance, the fisheries of the Great Lakes of North America, conducted by American and Canadian fishermen, yield annually in excess of 100 million pounds. In addition, many millions of pounds of fish are taken from other lakes in the United States and Canada and from the Mississippi River and its tributaries in the United States. The fisheries of the Amazon are important, as are those of the rivers and lakes of northern Europe and Asia.

24. Stocks of fish in many rivers and lakes have been increased through artificial stocking with hatchery-reared fish. The rearing of fish in ponds is also widely practiced in many countries, thereby adding materially to the local food supply. Pond culture is practiced extensively in China (especially in the paddy fields), in central Europe and the Balkans, and on many of the islands of the Pacific where both salt-water and fresh-water species are reared in ponds close to or connected with the sea. In the southern and southwestern parts of the United States fish produced in small farm ponds and in artificial

impoundments, created incident to soil conservation programs and irrigation projects, have become an important source of food. It is likely that if modern methods of pond culture were more widely adopted, a greatly expanded production of fish would result.

25. Available figures indicate that annual yields of such species as bass and sunfish from ponds in the United States are as high as 150 pounds per acre per year, whereas ponds artificially fertilized to promote the growth of food organisms show production up to 400 pounds per acre. This compares favorably with meat production on open ranges. Where ponds have been treated with artificial fertilizer, carp production per acre per year may approach 1,000 pounds. Some recent experiments have also been carried out on the west coast of Scotland where the branch of a sea-water inlet has been shut off from the main loch by a dam. The fertility of the water has been increased by the addition of artificial fertilizers and the results obtained so far are promising.

26. It is estimated that there are now in the United States 300,000 farm and ranch ponds, having an area of 360,000 acres. In connection with the soil conservation program in the United States, more than 23,000 farm ponds have been constructed and stocked with food fishes; this number could be increased several-fold. No doubt similar possibilities exist in other regions of the world. These, together with the prospects of increasing the productivity of lakes, rivers, and even the inlets and marginal waters of the sea itself by artificial fertilization and other means, might be developed quickly enough to add to protein supplies in some regions where acute shortages exist.

SUBSISTENCE FISHING AND ANGLING

27. Throughout the world many people fish in order to feed themselves and their families. While no records are available on the extent of this catch it probably exceeds a thousand million pounds annually. In addition, sport fishing or angling is practiced to a greater or lesser degree throughout the world. In the United States alone there are more than 8 million licensed anglers, and perhaps as many others in areas where no licenses are required. Their catch is roughly estimated at 250 million pounds annually.¹ Thus in the aggregate the catch by subsistence fishermen and anglers is by no means an unimportant contribution to the world's food supply.

WHALES AND SEALS

28. Except when prosecuted close to consuming centers where fresh meat may be sold, the whale fisheries of the world are not a direct source of food. They are, however, an important source of industrial and edible fats and oils. In recent years various other products, such as vitamins and hormones, have been extracted from whale organs. The place of the whaling industry in the fishery economy of the world must therefore receive consideration. Progress of the industry has been uneven owing in part to discoveries of new whaling grounds and subsequent depletion of their stock. Some species inhabiting the more easily accessible oceanic regions have been almost exterminated commercially. Since the beginning of this century the Antarctic regions

¹ U. S. Fish and Wildlife Service.

have supplied an overwhelming proportion of the world's whale-oil output ; in the last ten years before World War II they accounted for more than 90 percent of the world's total production. Production has been subnormal during the war period, and the greater part of the whaling fleets has been lost through war action. The whale fisheries long ago reached maximum production and international action was taken to conserve the resources ; hence, no possibilities for expansion of the total yield over that of prewar years can be envisaged. It may, in fact, take several years to rebuild the whaling fleets and bring production back to its prewar level.

29. Following are the total production statistics for the Antarctic season of 1938-39, and the summer of 1939 in northern latitudes :

TABLE II. WHALE PRODUCTION

Country	Total number of whales	Oil production (Barrels*)	Expeditions		
			Shore stations	Factory ships	Killer boats
British Empire ...	11,336	897,741	2	9	81
Norway ...	11,871	853,867	3	12	99
Japan ...	7,540	483,476	...	6	49
Germany ...	5,066	374,149	...	5	41
United States	1,388	102,388	2	1	13
Panama ...	907	68,853	...	1	8
Argentina ...	1,024	66,826	1	...	6
Soviet Union	476	18,854	...	1	3
Chile ...	407	5,797	1	1	4
Portugal ...	389	6,920			...
Denmark ...	178	5,197	2		7
Iceland ...	130	3,764	1		3
Total	40,662	2,887,832	12	36	314

* One barrel = 1/6 long ton.

30. Various species of seals are important in the diet of inhabitants of the Arctic regions. Commercial sealing is carried out on the herds of fur seals in the North Pacific, notably the Pribilof Islands. Among the seals of the North Atlantic the pelagic harp seals and hooded seals are hunted on the drift ice off Newfoundland, in the Jan Mayen-Greenland area, and in the White Sea. The pelts of these seals are utilized both as furs and for making leather, and they are also a source of industrial and edible fats and oils. Most important is the harp seal ; annual catches of this species varied in the ten years preceding World War II between 200,000 and 500,000 seals. While not a great industry by international standards, the seal fisheries are important in the economy of coastal populations in Newfoundland, Norway, and Northern Soviet Union.

3. POSSIBILITIES FOR EXPANDING WORLD PRODUCTION AND UTILIZATION OF FISH

31. Three possibilities exist for expanding the world production and use of fish : (1) more intensive prosecution of existing fisheries, (2) greater utilization of the catch, and (3) greater exploitation of little

developed fisheries. Few if any types of food production yield returns as quickly as does fishing—a point which is of special significance at a time when food shortages present problems of extreme urgency.

32. In view of these shortages, it would be well for the nations of the world, when planning their food production and nutrition programs, to give adequate consideration to the development of fisheries. One of the few remaining reserves of food, its potentialities have probably increased as a result of the war, which has made normal fishing impossible.

33. The world's great fisheries are in the Northern Hemisphere. While many of these before the war were exploited to the maximum, even to the point of overfishing, it seems likely that others could support more intensive fishing. The fisheries on the Grand Banks off Newfoundland can produce somewhat larger yields of certain species, as can the fisheries for flatfish off the Pacific coast of North America, especially off the Alaska peninsula. The cod fishery off Siberia and Kamchatka and the production of various kinds of herring in certain parts of the world might also be increased.

34. The amount of fish entering the markets of the world could be appreciably augmented if fuller use were made of the catch. As has already been pointed out, frequently it is not profitable to retain many species caught because they are not well-known to consumers and thus do not find a ready market. Yet most of these species are edible. It has been estimated¹ that more than 100 million pounds of food fish taken annually by otter trawls operating off the New England coast of the United States and by shrimp trawls in the Gulf of Mexico off the same country are discarded by the fishermen as being unmarketable. Also many million pounds of shark carcasses, suitable for production of salt fish, are returned to the sea after removal of the vitamin-rich livers. Continued education of consumers promises to develop a market for many little-used food fishes. The work along this line already accomplished during the war has proved very effective. There are also future possibilities in the expansion of the consumption of whale meat and of the production of pharmaceutical products derived from the organs of whales and fish.

35. While much more intensive exploration is needed to determine the location of underexploited fisheries, preliminary results of exploratory surveys² indicate the existence of a number of areas in the world where fishing can be safely intensified. Fortunately, many of these areas are near peoples whose diets are deficient in animal protein. Mexico can undoubtedly increase production to a considerable degree. Greatly expanded tuna fisheries can be conducted off Panama, the Galapagos, and parts of Central America. A considerable expansion seems possible along the west coast of South America, especially off Peru and Chile. These countries can supply salted, dried, and canned tuna and bonito, and other market species; shark-liver and other fish-liver oils; fish meal from anchovies; and industrial oils. Off the Bahamas, Cuba, and Venezuela, there seems possible a somewhat increased production of fish which could very profitably be used to supply the

¹U. S. Fish and Wildlife Service.

²Unpublished reports of preliminary and exploratory surveys conducted by the U. S. Fish and Wildlife Service in cooperation with certain American republics.

needs of the Caribbean area. The marine fishery resources of Brazil are underdeveloped. If increased production is obtained much of the yield could be used either fresh, or for canning, salting, drying and the production of fish-liver oils. The broad continental shelf running southeast off Uruguay and Argentina can produce enlarged yields for the same purposes.

36. Northwest Africa could probably make greater use of its sardine and tuna fisheries in canning and salting. The fishery resources off West Africa are large and can support much more intensive prosecution if equipment, facilities, and markets are provided. The fishery resources off Australia, New Zealand, the South Pacific Islands, and the East Indies are considerable, and capable of further development.

4. CONSERVATION OF FISHERIES

37. Fishery resources may be divided into (1) those that are found within the territorial limits of a country (the coastal marine, anadromous, and fresh-water fisheries), and (2) the offshore fisheries that are prosecuted beyond territorial limits.

38. The Food and Agriculture Organization of the United Nations is concerned with sustained maximum production and optimum utilization, consistent with principles of scientific management of all of the fishery resources. The conservation of fresh-water and anadromous fisheries, through laws or regulations, is undertaken by the governments of individual nations or, as in the case of the individual states of the United States of America, by political subdivisions thereof. One exception is to be found in the International Pacific Salmon Fisheries Commission established pursuant to a treaty between the United States and Canada. The sockeye salmon fisheries of the Fraser River system are the concern of this commission. Preliminary negotiations have been conducted anticipating a treaty within the near future between the United States and Canada for the conservation and management of the fisheries of the Great Lakes.

39. With reference to the marine fisheries outside the limits of territorial jurisdiction, various formal and informal organizations have been established. Their purpose is to coordinate scientific investigations and explore the possibilities of joint action by various nations to conserve and manage fishery resources in which two or more nations have a common interest. The Conseil Permanent International pour l'Exploration de la Mer, established in 1902, coordinates oceanographic and fishery biological investigations conducted by the member governments¹ in the eastern North Atlantic Ocean, the North Sea, and the Baltic Sea. It compiled and published fishery statistics for member countries for the years 1903 to 1937, inclusive. The North American Council on Fishery Investigations is an informal organization established by Canada, France, Newfoundland, and the United States, for the purpose of coordinating oceanographic and fishery biological investigations in the western North Atlantic. The Conseil International pour l'Exploration de la Mer Méditerranée was also established. Informal fishery advisory committees have been set up by Canada and the

¹ Denmark, Finland, Germany, the Netherlands, Norway, Russia, Sweden, and the United Kingdom were the original members. Belgium joined later.

United States and by the United States and Mexico for the purpose of studying international fishery problems and policies and making recommendations to be implemented by formal action of the respective governments. A joint scientific committee for physical and biological research in the Adriatic and a permanent fishery commission have been established pursuant to conclusion of a treaty between Yugoslavia and Italy. All of these organizations are purely investigatory and advisory in nature and have no regulatory power or other jurisdiction over the fisheries. The activities of those organizations whose member countries are in or adjacent to actual combat areas have been totally suspended. The North American Council also has been inactive since 1939.

40. Several international agreements for the purpose of conserving and managing marine resources have been concluded. The International Fisheries Commission, established as a result of a treaty between the United States and Canada, exercises regulatory jurisdiction over the Pacific halibut fisheries. It has succeeded in restoring to a productive level an important fishery resource which, through unwise and excessive fishery, had reached a state of alarming depletion twenty years ago. An international whaling convention concluded between the important whaling nations of the world, except Japan, and various agreements amendatory to it, have provided an international cooperative method of regulating the capture and processing of whales throughout the world. Each signatory nation is charged with the responsibility of enforcing the provisions of the international whaling agreements with respect to its own nationals. An international treaty for the preservation of the fur seals and sea otters of the North Pacific Ocean was concluded between Japan, the Soviet Union, the United Kingdom, and the United States in 1911. This treaty resulted in the complete restoration and very profitable management of the badly depleted fur-seal resources of the North Pacific. The treaty was abrogated by Japan in 1940. However, Canada and the United States thereafter concluded a provisional agreement which maintains the stipulation of the 1911 treaty as applied to nationals of the two countries. Although the Soviet Union is not a signatory to the provisional agreement, it nevertheless is voluntarily following the stipulations of the 1911 treaty. It is anticipated that a new treaty to replace the provisional agreement will be negotiated as soon as world conditions permit.

41. Conservation of the fishery resources of the high seas is a complex subject and, despite the intensive investigations that have been conducted in specific localities, knowledge of facts fundamental to sound management of high-seas fisheries is still fragmentary. Since the beginning of the present war in Europe, many very productive fishing areas have been fished to but a fraction of their normal capacities. Fishing vessels and crews have been requisitioned for military and naval service. Moreover, many areas lie in active combat zones where fishing operations have been extremely dangerous, if not impossible, because of mines and other hindrances to the use of nets. During this period of reduced fishing activity, the formerly over-exploited fishery populations of certain areas have had an opportunity to restore themselves. Immediately following the war when the fishing industry is reestablishing itself, appropriate action to maintain the fishery resources at an optimum level of abundance will be particularly

timely. However, this can be accomplished only by cooperative and concerted action on the part of nations that may share in specific fishery resources. In 1919, following the war years of 1914-1918, such an opportunity existed in the North Sea where the depleted fishery populations had multiplied owing to curtailed fishing activity. The opportunity was lost, and within a very few years after the resumption of normal fishing activity the quantities of the principal species had again been reduced to such low levels that fishermen had to seek areas outside of the North Sea in order to obtain profitable catches. This lack of foresight should not be allowed to recur; it need not recur if the countries concerned reestablish scientific investigations immediately, and undertake from time to time such regulatory action as scientific evidence dictates.

42. In other parts of the world, also, conservation of the high-seas fisheries should receive attention through appropriate international action by adjacent countries, in order to avoid the ever-present danger of overexploitation and to maintain important sources of protein foods at optimum levels. Only through such sustained production may the fishing industry, and the employment and trade opportunities provided thereby, be maintained at prudent levels.

43. The war has stimulated the development of new fisheries which have contributed products extremely valuable for food, pharmaceutical, and industrial uses. After the war, some of these fisheries may not be prosecuted as heavily as at present; on the other hand, there may be others still awaiting discovery.

44. Since fishery conservation problems on the high seas are international in character, international action is essential. That this is so is recognized in paragraph 54 of the *First Report to the Governments of the United Nations by the Interim Commission on Food and Agriculture*.¹ Because the problems of conservation are different in the many areas involved, international action for conservation and management will generally be more effective when on a regional basis. Countries most vitally concerned with the fisheries of a particular marine area are in the best position to maintain scientific investigations, to assess the character of the fisheries and changes in quantity levels, and on the basis of such information to suggest necessary regulatory measures. There should be a free interchange of ideas and information between such regional authorities. This could be accomplished by means of an arrangement sponsored by FAO with the regional authorities.

5. FISH-PROCESSING INDUSTRIES

45. The perishable nature of fishery products and the fugitive character of their flavors make it desirable that preservation processes be carried out as soon as possible after the fish are caught.

46. Fish are prepared for market by icing, freezing, canning, and curing (salting, drying, and smoking), in addition to being marketed fresh as caught.

47. Salting and drying are among the oldest methods of processing: they were probably discovered by chance and applied to fishery products before they were applied to other foods. Many years passed before a new method was discovered. Canning was introduced about 1800, but it was not until the Civil War in the United States precipitated the

¹United Nations Interim Commission on Food and Agriculture, *First Report to the Governments of the United Nations by the Interim Commission on Food and Agriculture*, Washington, August 1, 1944, p. 20.

need for nonperishable foods that it became the preferred method of keeping foods from the time of production to the time of use.

48. Transport difficulties during World War I showed the need for concentrated foods, and to meet this demand the possibilities of dehydration were investigated. There has been considerable research on dehydration of fish and other foodstuffs but the results with respect to fish have not brought about important changes in the industry.

49. In the canning industry, research designed to better the canning of fruits and vegetables has led to improvements that have been applied to the canning of fish.

50. There has been considerable research on the salting of fish. In recent decades, methods of salting and drying used in various areas have been altered by such innovations as the inclusion of preservatives and the use of artificial driers.

51. High water and air temperatures combine to accelerate the decomposition which starts when the fish are caught. Control of this condition has been achieved by the use of ice to chill or to freeze, but these preservative methods are not extensively used in many areas where the adverse conditions are most prevalent. Quick freezing, recently applied to fish at the point of capture and to fish fillets and other cuts at the landing points, has promoted the more extensive use of fish and is capable of great development. An important limiting factor is the scarcity of facilities for distribution and retail display. Just prior to World War II, these facilities were expanding, and with the return of peace this trend should be resumed. Freezing operations are largely based on research, and much work, though not all that could be wished for, has been accomplished in the field.

52. According to rough calculations based upon the latest available figures, the world production of canned fish amounts to about 2,000 million pounds annually, and that of cured fish to about 3,000 million pounds. The most important canned-fish-producing countries are the United States with 700 million pounds; Japan, 300 million; Spain, 230 million; Canada, 190 million; Portugal, 150 million; and Norway, 110 million. The Soviet Union, with an estimated prewar production of 500 million pounds, is the most important producer of cured fish. It is followed by Norway with 420 million pounds; the Netherlands, 200 million; the United Kingdom, 150 million; Canada, 140 million; Iceland, 136 million; Newfoundland, 120 million; and the United States, 100 million pounds.

6. PRODUCTION FOR FOREIGN MARKETS

53. Canned and cured fish form the basis of international trade in fish products, although, of course, many other types are exchanged in world markets. According to a recent tabulation, the principal fish-exporting countries of the world shipped to other countries fishery products amounting to about 5,000 million pounds, leaving 32,000 million pounds for home consumption.

54. Nevertheless, a number of countries produce much more fish than can be consumed at home. Notable examples are Canada (Maritime Provinces), Iceland, Newfoundland, and Norway. Fishing is one of the principal industries in these countries (in Iceland it is the major industry) and they export most of their catches.

55. In many countries the more expensive kinds of domestically produced fishery products are exported and the less expensive, imported. Italy and Portugal, for example, export canned sardines and anchovies, both relatively high-priced articles, and import salted cod, a relatively low-cost product.

PART III. MARKETING

56. Markets for fish, as for other foodstuffs, particularly the more expensive protective kinds, are profoundly affected by the purchasing power of the consuming public. This in turn depends upon levels of employment and general prosperity. Inefficiencies in the fishery industry itself have contributed toward the instability of the market for fish, for too often fish in retail shops is inferior in quality and high in price as compared with alternative foods.

57. The Hot Springs Conference¹ recommended that all countries take resolute action separately and together to secure an expanding world economy. Such an expansion would greatly increase the demand for fish, as well as for many other foods; but the industry itself must make a contribution by using the best methods of preservation and processing and by reducing the spread between prices at ports of landing and at retail.

58. The international difficulties of the fishing industry in the inter-war period arose out of market gluts of certain species and types of product, generally low prices for fish, high tariffs, and government subsidies in certain producing countries. But most of these conditions were surface manifestations of more basic difficulties. Apart from the effects of the last war, which caused production to expand in certain countries, and the swing in international trade from boom to depression, the basic difficulties in the fishing industry and their causes in the inter-war period may be summarized and discussed under three heads:

(1) *The relation of the fishing industry to other food industries.* In the inter-war period, the fishing industry in the world at large was affected more by factors outside the industry than by those within it.

Like other food industries, fishing was affected by the fact that food consumption increased very little in comparison with the rise in incomes in the countries of the Western world. Fishing was also limited by the declining rate of population growth in fish-consuming countries. In addition, fish prices dropped in Europe and North America in sympathy with the lower prices of farm products; and in certain agricultural countries in South America, the West Indies, and elsewhere, the existence of agricultural surpluses brought a decline in the value of fish purchase, especially those of salt fish.

¹The term "Hot Springs Conference" refers to the United Nations Conference on Food and Agriculture, which met at Hot Springs, Virginia, U. S. A., from May 18 to June 3, 1943. Its *Final Act and Section Reports* were printed by the U. S. Government Printing Office, 1943, as Publication 1948 of the Department of State Conference Series 52. (International documents are published concurrently by a number of the participating governments. Specific citations are given here to the documents as published by the U. S. Government.)

Technical advances in agriculture outran cost-reducing innovations in the fishery industries with far-reaching effects. Agricultural research was organized on a wide scale and in many countries agricultural information was disseminated by extension services, whereas the fishing industry had nothing comparable, either in research or in industrial development. Fishing vessels remained tailor-made; supplies of fish were generally never great enough or steady enough to warrant building processing plants comparable with those for meat packing; nor was the distribution and marketing technique as highly developed as for many farm products.

(2) *The perishable nature of fresh fish.* The extreme perishability of fresh fish affects the organization of the industry and its world trade. Some of the great fishing grounds (Grand Banks, Iceland, Bear Island, for example) are located far from consuming centers, and preservation of the fish requires careful icing, freezing, or salting. Salting was the traditional method, icing was becoming general on trawlers, but freezing at sea had limited possibilities. Each method represents a different cost structure. Freezing requires the highest proportion of capital to labor, icing the next, and salting the lowest, but fishing on all these deep-sea grounds requires an investment for equipment greater than that for labor. In inshore fishing, on the other hand, labor represents four fifths of the total cost. Before the outbreak of the present war some countries, such as Newfoundland and Iceland, near the great fishing grounds, were practically confined to salting for export because of their small populations and limited capital. Fishermen of other countries more remote from the Grand Banks, but having more capital and larger populations, fished these grounds with more expensive equipment, principally larger trawlers. In Europe in particular costs for fishing the remote grounds were rising, yet the quality of the landed product was not improving and was even declining. Canning, as distinct from freezing and salting, was used mainly for those species (salmon, sardines, shellfish, etc.) that came inshore in relatively large quantities. Here the operating costs of fishing itself tended to be smaller.

The various products had different markets. Fresh, frozen and smoked fish were sold mainly in the wealthier countries where distribution systems were highly developed, and the various species usually competed closely in the market. The canned product was sold mainly as a luxury in the same countries. The salted fish of the cod family, apart from its delicatessen uses in the richer countries, was destined mainly for agricultural countries. Where living standards were rising the demand for salted fish fell off, although salted herring had special traditional European markets.

(3) *The nature of fish production.* The seas are free, and the fish within them are a gift of nature. Fishermen, therefore, need only labor and capital to obtain their stocks. This has three important results; (a) Even if the fish stock on a given ground is fairly constant over long periods, the chances of the individual on any trip are uncertain. The landings are subject to wide fluctuation in volume and in proportions of the species taken, some of which may have little or no commercial value. (b) Sometimes

areas are overfished, as has been mentioned previously, and the responsibility for conserving stocks has to be undertaken by governments on a national or international basis. (c) In terms of marketing, the free stock influenced the direction of trade. Thus, for example, cod on a given fishing ground might be taken by fishermen from Canada, France, Newfoundland, or the United States, and on their traditional practices and the facilities available to them would depend the type of ultimate product and the market to which it would be offered. The relative availability of capital to fishermen of different nations thus tended to determine the nature and the flow of the international trade in fish. International competition in fresh fish was limited by the perishability of the commodity, and therefore, took place mainly between contiguous countries. The great international trade was in salted fish and canned fish of certain species. By 1939 frozen fish was becoming an international staple, a development that will be furthered as refrigeration facilities on ship and shore improve and are extended.

59. Between the wars, therefore, the fishing industry in certain countries had to depend largely if not entirely on the trade in salted fish; but in the richer markets the demand for salt fish was falling off, and in the poorer markets, to which this product was mainly shipped, incomes were becoming lower because of world economic changes. As a result, some fish-producing countries suffered a severe drop in income. Fishermen in the richer countries, on the other hand, had access to more capital and were able to diversify their products—as fresh, frozen, smoked, or canned—but occasionally they had to go so far for their raw fish that the quality was low. These countries usually had a class of shore fishermen lacking capital and access to fresh markets and almost as limited in their scope as the fishermen in the salt-fish-producing countries. Sometimes these shore fishermen had readily available supplies of shellfish or seasonal runs of pelagic fish that would yield them fair returns on their small capital, but often their economic status was comparable to that of fishermen in the salt-fish countries. Both groups were short of capital and were relatively immobile. In the richer countries such fishermen increased in numbers when general depression in industry drove men out of the cities back to farming and fishing, and their income was accordingly diminished. Occasionally the national political influence of these groups was great enough to prevent technical progress in the more highly capitalized parts of the industry in these countries, which hurt the industry as a whole in competition with other food industries for markets in the richer countries.

60. During the inter-war period, production of almost all forms of processed fish tended to exceed current effective demand, not to the extent of building up year-end surpluses such as existed in the case of some agricultural commodities, but to the point at which salt-fish exporters in particular had to sell at a sacrifice to prevent a carry-over and the consequent loss of semiperishable goods. In the fresh, smoked, and frozen fish business, the price had to be such as to keep the supply moving constantly in competition with other food products.

61. In the future the fishing industry will probably have to look towards the possibilities in frozen rather than salted fish, especially in countries where higher income levels and increasing knowledge of

nutrition may create a desire for more variety in foods. Only in this way can the industry compete successfully in the food markets of these countries. Greater equity in the distribution of income in these countries also may enhance the demand for fish. Special food distribution methods, as in-school meals and food-stamp programs, also might encourage the use of fish for its food value.

62. The fishing industry in all countries needs to make considerable technological advances in both production and distribution. Countries primarily devoted to fishing and depending mainly on fish exports will need capital to make such advances. Even then, shore fishermen may fail to find enough employment, and migrations to manufacturing centers may be necessary. Those countries which are near the great fishing grounds may have cost advantages in producing high-quality frozen fish over more remote countries where large trawlers must be used to carry raw fish long distances. Even in countries with more diversified production, technical advances may not provide employment for large numbers of casual fishermen, some of whom may have to seek employment in manufacturing industries.

63. Improved equipment for handling frozen and other processed fish may reduce the cost of distribution, eliminate losses from deterioration, and lower prices, especially retail prices. There will always be some instability in landings, but the fluctuation can be decreased. Conservation of stock on certain fishing grounds may necessitate government action. This problem has been less acute in the western Atlantic than in European waters, but it is inherent in all fishing.

64. It is conceivable that many of these problems would be solved if the barriers to wider distribution of fishery products would be removed. As pointed out above, this will depend in part upon increased efficiency of production, manufacture, and distribution which should follow the application of knowledge, as well as upon improved economic conditions in general.

65. The emergence of cooperative enterprise is also having its influence on the fishing industry, but while this may have the effect of distributing the proceeds more widely, it leaves the basic problems still to be solved.

PART IV. DEVELOPMENTS SINCE WORLD WAR I

1. PRESENT TRENDS

CANNING INDUSTRY

66. Following World War I, great strides were made in fish canning. Improved techniques resulted in a more sanitary product, and mechanical improvements in processing methods led to a larger output per man-hour; this was especially noticeable in the salmon canning industry.

67. During the same period, conservation measures limited the number of fish to be taken for canning. As the number of canneries increased, competition for the limited supplies of raw material also grew and, as a consequence, methods of catching became more efficient. The inevitable result was the shortening of the canning season which in turn increased overhead expenses—such as the transportation and housing of labor—in relation to the period of operation. At the same time, the influence of world competition for the raw material brought about a depreciation in prices for the finished product. These factors together made necessary still further savings in costs by the introduction of high-speed, labor-saving canning machinery.

FISH-FILLETING INDUSTRY

68. Through the introduction of fish fillets great progress was also made in the handling of fresh and frozen fish. Formerly most market fish were shipped whole or dressed, either unfrozen in ice or frozen. With the introduction of filleting, which removes the bones from the meaty portion of the sides of the fish, only the edible portion of the fish reached the consumer. Originally the fillets were shipped fresh in ice, but later large quantities were frozen and packed for refrigerated shipment. The consequences of the introduction of this new technique were several; not only did the market for both the fresh and frozen products expand greatly, especially among apartment dwellers and restaurant keepers, but savings were made through the reduced shipping weights and decreased spoilage. Furthermore, the waste products of the fish could be accumulated at production centers for reduction into fish meal and oil.

FISH-MEAL AND-OIL INDUSTRIES

69. During the inter-war period the fish-meal and -oil industries grew considerably. Fish meal, formerly considered useful only as a fertilizer, came to be used as an animal feedstuff. As such it provides protein of high biological value, and diverse minerals; thus it is widely used in rations for poultry, pigs, and young growing cattle. For instance, when 10 percent of fish meal is added to 90 percent of cereal, and the mixture fed to poultry, the nitrogenous and mineral supplements provid-

ed by the fish meal result in a much more efficient growth of the fowl and an increased production of eggs.

70. The body oil from fish and other marine animals, such as whales and seals, amounts to about 1,400 million pounds per annum; it has a large number of industrial uses for it can be interchanged with many other oils and fats in the preparation of leather and in the manufacture of such products as soap, paint, and linoleum. Some fish oils also have special uses as lubricants and core oils and large quantities have been used in the manufacture of margarine. Some fish-body oils prepared from white fish are the source to a greater or lesser degree of vitamins A and D and are used in feeding farm animals.

71. Fish-liver oils are one of our most important sources of vitamins A and D for human consumption, and in recent years its use has been extended to animal feedings. Cod-liver oil has been a household item for centuries, but only in the last decade has a use been found for the liver oil of other species. The livers of tuna, bonito, shark, halibut, swordfish, and many other species are now utilized in the commercial preparations of vitamins A and D. Since the liver of sharks (particularly the soup-fin) is one of the richest sources of vitamin A, there has been an extended search for this fish, which was formerly considered a nuisance by fishermen. Such exploitation may lead to depletion of the supply.

2. IMPACT OF WORLD WAR II

72. The immediate effect of World War II was to reduce the amount of fish available to many consuming markets. To alleviate this situation, the fishing industry in Allied countries not affected by belligerent action was called upon to supply, under the most adverse circumstances, ever-increasing amounts of food and other products derived from the sea. At the height of the war in 1943, the production of fish by the neutral countries was estimated at 1,000 million pounds; by the Axis and Axis-controlled and -occupied countries at 15,000 million pounds; and by the United Nations at 12,000 million pounds. The combined total of these quantities represented a decline of about 9,000 million pounds from the prewar world production of fish.

73. As the western European countries were overrun by the Axis powers they were no longer able to export fish. This affected especially the United Kingdom and the Americas. Because of enemy action, loss of manpower, and requisitioning of a large part of the fishing fleet, the United Kingdom, as well as a number of other countries, was forced to lean heavily on other Allied or neutral countries for a supply of fish. A large part of the deficit was made up by Canada, Iceland, Newfoundland, and the United States.

74. Prior to World War II, most of the Icelandic production of white fish was salted. With the coming of the war and the disruption of British fishing in the eastern North Atlantic, Iceland became the principal source of fresh fish imported by the United Kingdom. While most of this was received as fresh iced fish, greatly increasing quantities were delivered as frozen fillets. In fact Iceland has become one of the principal world producers of frozen fish fillets and at present only a small fraction of the catch of white fish is salted.

75. In the early years of the war, manpower shortages made it difficult for Newfoundland to maintain fish production; nevertheless it con-

tinued to supply large amounts of salted and frozen fish. Shortages of manpower, vessels, and supplies were also experienced by Canada and the United States but exports were increased, principally at the expense of civilian consumption of canned fish. In both these countries labor-saving devices have been installed in the filleting plants—devices which in some cases have resulted in higher yield of edible material per unit weight of raw material.

76. The peoples of the West Indies found it difficult to secure normal quantities of imported fish, especially salt fish, because of shipping problems and because of the huge demand for fish by such neutrals as Spain and Portugal. Some of the shortages were remedied by substituting other species for those normally imported and by securing fish from new exporting countries.

77. During the war, improvements have been made in the handling of salted and dried fish of various types in an effort to maintain the quality and "shelf life" of the product. Most countries producing salt fish have introduced inspection systems which in the long run should lead to more efficient marketing and distribution both nationally and internationally.

78. With the disappearance of Scandinavian salt fish from world markets during the present war and the lack of alternative foods, government policies in many salt-fish-producing countries have been directed toward increasing production, while other countries, for example Peru, not normally engaged in such production have turned their efforts toward the salting of fish. On the other hand, the diminution of the European deep-sea fishery has led to an increased demand for frozen fish, which in the western Atlantic area has been produced largely at the expense of the salted product.

79. Following the war it is likely that the salt-fish industry will be revived to some extent in countries, such as Iceland, where it was previously important. It may again become one of the principal methods of processing fish in new fish production areas to supply a needed animal protein food at low cost to local peoples, as in Liberia. Though great care must be exercised in salting and curing fish, the use of complicated machinery is not necessary.

80. Research on dehydration is very recent, but some knowledge gained in the dehydration of meat is applicable to the dehydration of fish. Most of the work done so far in developing the technique of fish dehydration has been designed to dry cooked fish rather than to keep the fish in such a condition that when rehydrated it will resemble the raw product. If dehydrated fish having the latter quality and the taste appeal of the fresh fish can be produced, far larger markets will be available, thus tending to move local surpluses and exercising a stabilizing influence on the industry. However, much research must be done before this end is achieved.

81. The disturbed conditions—including shortages of labor and materials and excessive demand—brought about in the fishing industry by the war have made it difficult to maintain high standards of quality. On the other hand, the combination of shortages and great demand has resulted in more complete utilization of fishery products. Quantities of fresh, frozen, and dry-salted shark meat are now used for human consumption, and vitamin A concentrates from shark-liver oils have

been used to fortify foods. It has been demonstrated that menhaden (a herring-like fish) can be prepared as an appetizing canned product while large sea herring, formerly not canned to any extent, are now so prepared in great quantities. Other new developments in the canning industry include the packing of sardines in tall instead of flat containers with greater economy of labor; the preparation of acceptable new canned products from the waste portions of salmon formerly discarded in cannery operations; and the development of an excellent quality of canned fish flake from lake carp. During the war the United Kingdom has become a large consumer of frozen fish and fillets. It may well be that preference for these products will develop and continue during the postwar years, thus bringing about greater utilization of fishery resources.

82. A particularly noticeable aspect of the increased efficiency in the technique of catching fish is the improvement in vessel design. Many of the newer vessels, built during the war, are of the "all-purpose" type—that is, they are so constructed that they can be used for fishing with four or five types of gear rather than with one only, for example, a purse-seine, an otter trawl for bottom fishing, or a hook and line for live-bait tuna fishing. A number of these newer vessels are also equipped with refrigeration facilities to freeze the catch at sea, thus assuring the delivery of prime-quality fish at the port of landing. Although these improvements involve large investments, they reduce operating expenses.

83. Wartime research on the location of submarine bodies has resulted in the development and refinement of the electrical apparatus involved; these new advances promise to be of service in locating schools of fish such as herring and pilchards.

84. The increased demand for fish has also encouraged a number of countries to expand fish production for use at home as well as abroad. Notable examples are Mexico, Peru, and Chile—all of which are countries with abundant fishery resources.

85. One basic problem faced by all fishery industries relates to the nature of the raw material used. The crop is not only unpredictable but irregular in supply and of an extremely perishable nature. Alternate gluts and scarcities are characteristic of the industry.

86. These risks limit the flow of capital to the fishing industry and explain the difference between this and other food industries where supplies of raw materials are more predictable and consistent, and subject to better control. Fish plants and factories must have the capital, machinery, ancillary material, and labor necessary to cope with maximum landing—all facilities that are left unused during times of scarcity. Thus the overhead expenses are increased and, in turn, the cost of the finished product is relatively high, although at the point of production fish is among the least expensive of foods.

PART V. RECOMMENDATIONS

87. In accordance with the terms of the proposed Constitution of the Food and Agriculture Organization of the United Nations, the Committee recommends the following as some of the immediate functions of FAO in the field of fisheries :

(1) Collection, analysis, interpretation, and dissemination of information relating to fisheries and fishery products. The collection of information on fisheries of various nations is of great importance, and the establishment of systems for the collection and publication of fishery data should be encouraged in all countries. Furthermore, provision should be made for the exchange of fishery publications between the various countries, an exchange to be encouraged by FAO.

It would be advisable for FAO to arrange for the periodic publication of a catalogue of sources of fishery data, so that published reports will be made known to Member nations and to institutions concerned with fisheries. Agencies publishing reports relating to fisheries should be encouraged to print summaries of them so that they may be more easily utilized by research workers.

Eventually it may become desirable for FAO to arrange for the publication of digests of new and important contributions to the knowledge of fisheries. In general, reports of the physical and nutritional sciences are available in standard publications ; however, economic and sociological publications and those dealing with fish-handling techniques are not so widely distributed. There is no doubt that administrative officials of various governments and policy makers would be greatly assisted if they had available, in some form, digests of significant contributions to the knowledge of world fisheries.

Fishery statistics form such a vital section of knowledge that a special effort should be made to encourage the collection and publication by Member nations of basic fishery data. Furthermore, it is important that all countries follow comparable methods of collecting and reporting data ; to achieve this end FAO should arrange for a conference looking toward adoption of uniform methods.

(2) Scientific, technological, sociological, and economic research relating to fisheries and fishery products.

(a) *Biological research.* Fundamental to the intelligent consideration of fishery resources are investigations to determine : (1) the natural history, distribution, migrations, and environmental relationships of fishery species ; (2) the size, extent, and annual and seasonal variations in abundance of fish populations ; (3) the effect of continuing fishing operations on abundance ; (4) the most efficient methods of obtaining

maximum sustained production without endangering the future supply ; and (5) effective methods of artificial propagation, stocking, and disease and pollution control. The methods and results of these coordinated phases of biological research had begun to attain exact and fruitful levels immediately prior to the war. The scope and magnitude of such research varied considerably among the various primary fishing nations of the world, and some conducted none at all. In no country was the extent of such research commensurate with the magnitude of the fishery resources.

FAO should, as soon as possible, encourage the resumption of suspended or curtailed fishery biological research and the establishment of such new researches as are necessary to keep pace with fishing activity. FAO should emphasize the need for continuous investigations to maintain at all times knowledge of the condition of the resources as a basis for perpetuating sustained production. It should encourage cooperation in research by nations that share the same resources. FAO should also facilitate the interchange of biological information, stimulate the provision of better research facilities, and encourage the exchange of students and research workers among nations in order to promote better opportunities for scientific training as well as to ensure the coordination of activities and the improvement of research techniques.

(b) *Nutritional research.* Research done heretofore, designed to identify and appraise the nutritional components of fishery products, appears to be fairly adequate with respect to protein, fat, mineral content, and digestibility. There is a large volume of this information available, and scientists continue to investigate all new phases in this field as advances in international knowledge and techniques are made. The present information, and the results of new studies as they are completed, should be utilized to the fullest extent in order to popularize fish as an excellent source of protein food in countries suffering from dietary protein deficiency.

It is suggested that FAO study the desirability of increasing the consumption of fish protein in various areas of the world where the present diet consists largely of cereals and pulses.

(c) *Technological research.* In recent years a great mass of information has been assembled on the technological phases of fish production and processing covering the handling of fish aboard the boat or vessel ; the preparation of fish for market by icing, freezing, salting, drying, canning, etc. ; and the warehousing, storage, and transportation of fishery products. Much work has also been done in the field of fishery by-products, such as fish meal and oil, and in the development of mechanical devices for their preparation. While much still remains to be accomplished in this field, it is believed that existing knowledge is so far in advance of application that the efforts of FAO should be directed toward securing the adoption of these improved methods. This could be achieved through the establishment of some form of clearinghouse for reports covering research done heretofore, thus making the reports available to

all research workers interested in obtaining information on the scientific handling of fishery products.

It is also suggested that FAO sponsor periodic international conferences of fishery technologists to discuss the problems arising in the various countries. This would enable workers who are actively engaged in fishery research to become more widely acquainted with the problems confronting workers in other countries and to exchange ideas that could contribute to the solution of such problems.

(d) *Sociological and economic research.* Since, in many instances, fishermen and shore workers are in the low-income group of labor, more attention should be given to helping them improve their general well-being. The problem of full employment is also vital to the postwar world. Therefore it is recommended that FAO cooperate with such international bodies as those concerned with labor, health, and education to encourage the initiation of studies on such subjects as the relation of fishery methods to production and employment, to general well-being and public health, to occupational hazards and diseases, and to opportunities for education and community life.

Very few studies have been made in the field of fishery economies but the solution of many fishery problems must depend upon such knowledge. It is therefore incumbent upon FAO to encourage the primary fish-producing and fish-consuming nations to undertake efforts in this direction. Research should extend not only to the economies of production, processing, and distribution (involving studies related to costs, prices, and investments) but also to consumption. It should likewise cover problems of collective bargaining and labor organization, recruitment and labor exchange, social security, employment under "lay systems" or fixed wages, living conditions and adequacy of income, insurance laws, credit unions, and cooperatives.

(3) Improvement of education relating to fisheries and fishery industries and the spread of knowledge of fishery science and practice. Experience and the dissemination of information relating to developments in scientific agriculture have greatly increased man's knowledge of the world around him. And many of the new techniques developed for agriculture are susceptible of application to fisheries. To apply these techniques to fisheries it would be necessary first to establish fishery schools or curricula comparable in their scope with agricultural schools.

Therefore FAO should encourage the establishment of fishery schools or fishery courses at appropriate existing institutions. As in the case of agricultural schools in many countries, these could serve as training centers for students specializing in fisheries. The schools should be the centers of extension work for the dissemination of information to fishermen and shore workers.

It is also recommended that FAO encourage further develop-

ment of existing research centers and, if necessary, the establishment of new centers located in the major producing regions and in other areas where fisheries might be more fully developed. Among other activities these laboratories could serve as the focal point for conducting systematic fishery exploratory work to locate virgin fishing grounds and for demonstrating newer techniques of producing, processing, and marketing marine products; they could also study biological, economic, and technical problems of special concern to the area in which they are located; and they could function in co-operation with existing fishery councils. Likewise FAO should encourage the operation of research vessels.

(4) Conservation of fishery resources and the adoption of improved methods of fishing.

(a) *Conservation.* For the present at least, it is recommended that FAO confine its efforts in the field of conservation to stimulating interest in fishery research and development and to promoting international forms of cooperation and management. This would lead to greater future utilization of fishery resources.

Fishery conservation problems on the high seas are international in character but because the problems of conservation are different in the many areas involved it is considered preferable for any international action for conservation and management to be established on a regional basis. There should, however, be a free interchange of ideas and information between such regional authorities in order to assist in bringing about a wider degree of coordination and interest. It is therefore recommended that Member nations be invited to consider the desirability of arranging periodic conferences between regional authorities, including established national and international councils for the study of the sea.

One of FAO's immediate activities should be to draw the attention of its Member governments to the necessity of reviving, as soon as belligerent action ceases, existing international organizations for the study of the sea and fishing. In this connection, special attention should be given to those organizations dealing with areas most affected by the war such as the Counsel Permanent International pour l'Exploration de la Mer.

It is further recommended that the attention of governments be drawn to the desirability of reestablishing councils to formulate problems and to coordinate sea research in areas not served by such organizations at the present time.

FAO should lend all possible support to the development of international programs of cooperative research and, wherever necessary, of joint regulatory action on a regional basis to conserve and bring about the proper management of fishery resources.

(b) *Improvement of fishing.* In regard to the adoption of improved methods of fishing it is recommended that FAO

FIVE TECHNICAL REPORTS ON FOOD AND AGRICULTURE

encourage practical demonstrations of modern fishing vessels and gear. The laboratories referred to in the third recommendation could well serve as centers for these demonstration activities. The vessels and equipment could also be used to determine the potentialities of virgin areas.

FAO should also encourage the adoption of pond-fish culture wherever facilities and conditions for the propagation of fish, including the actual or potential availability of suitable small lakes, ponds, or artificial impoundments, render such programs practicable.

(5) **Improvement of the processing, marketing, and distribution of fishery products.** The fundamental problem of irregularity of supply should be the concern of all maritime nations. More efficient methods of catch must be employed and, above all, work must continue on the application of newly developed methods of preservation which can act as a buffer against fluctuations in the supply of raw material. These, coupled with improvements in transportation and in distribution systems, would mean a more constant flow of fishery products to the consumer. A constant flow of products is one of the essentials for any considerable expansion in consumption.

(a) *Processing.* Processing covers the entire field of fish preservation, including freezing, canning, drying, salting, smoking, and the manufacture of fish by-products. As has already been mentioned, a wealth of information is available on newer and more efficient methods of processing fishery products.

It is recommended that FAO encourage the assembling of this information in usable form for dissemination to Member governments and that, where the need exists, Member governments be encouraged to demonstrate the newer processing methods and techniques. This might be accomplished by the assignment of qualified experts to Member countries upon request. In this connection, the possibilities of using the laboratories referred to in the third recommendation should not be overlooked.

(b) *Marketing and distribution.* It has been stated earlier in this report that there is a wide spread between the landed value of fish and its retail price. Fish, one of the least expensive food products at the point of production, becomes one of the more expensive foods in the retail store. Many reasons have been advanced for this situation, but the fact remains that it retards consumption. Some studies of causative factors in the chain of marketing and distribution have been made but they have not led to a solution. However, studies might be undertaken to bring about some measure of standardization of quality, packaging, and weight.

FAO should encourage the extension of these studies for the purpose of acquiring knowledge and recommending procedures that will bring fish within the reach of low-income consumers.

(6) **Adoption of policies for the provision of adequate fishery credits, national and international.** Fishery industries in general are undercapitalized; however, technical advances should go a long way toward removing certain of the great risks that have militated against the investment of capital. The pursuit of technical progress will be national in scope; FAO should encourage governments to grant credits for such purposes, and should be prepared to give expert advice when it is required.

Countries, such as India, China, and others, where lack of protein is an outstanding nutritional deficiency may stand in need of international credits in order to develop their fisheries. If such international credits are made available it is recommended that the steps contemplated for agriculture (paragraphs 68 and 69 of the Interim Commission's First Report to Governments) be extended to fisheries.

(7) **Adoption of international policies regarding commodity arrangements for fishery products.** Commodity arrangements can be successfully applied only to preserved or nonperishable material. Fisheries include only a few staples of this type, one of them being salted fish. Nevertheless, FAO should study the possibilities of commodity arrangements as they affect fisheries, particularly as they promote or hinder better orientation of production and as they may be effective in providing opportunities for supplying consumer markets from the most efficient sources of production. As an integral part of this program, FAO should study the effects of tariffs and other international barriers on world trade, as well as the effect of abnormal fluctuations in the exchange rates, which restrict the production, distribution, and consumption of fishery products. Such information should be furnished to the governments of producing and consuming countries¹ and to other interested authorities.

¹See United Nations Interim Commission on Food and Agriculture, *op. cit.*, Washington, August 1, 1944, Appendix I, "Constitution of the Food and Agriculture Organization of the United Nations." Article I, paragraph 2 (a).

APPENDICES

I. COMMERCIAL FISHERIES OF THE WORLD

FISHERMEN, FISHING CRAFT, AND PRODUCTION BY CONTINENTS AND COUNTRIES

Continent and country	Year	No. of fishermen engaged	No. of fishing craft	Quantity (Thousands of lbs.)	Remarks
<i>North America</i>					
Canada ...	1941	63,745	37,708	1,198,865	
Central America and West Indies:					
Bahamas ...	1936	390	65	1,275	
Barbados ...	1940	1,900	536	1,000	
British Honduras ...	1940	...	...	500	
Costa Rica ...	1940	...	...	1,000	Estimated
Cuba ...	1940	...	...	15,000	"
Dominican Republic ...	1940	...	...	1,000	"
El Salvador ...	1940	...	...	700	"
French West Indies ...	1940	...	...	9,000	"
Guatemala ...	1940	...	...	100	"
Haiti ...	1940	...	...	2,000	"
Honduras ...	1940	...	...	300	"
Jamaica ...	1940	1,200	400	10,000	"
Leeward and Windward Islands	1940	1,437	327	3,600	" (Men and craft for Leeward Is. only)
Netherlands West Indies ...	1940	...	...	1,000	"
Nicaragua ...	1940	...	...	300	"
Panama ...	1940	...	...	3,000	"
Puerto Rico ...	1940	1,403	716	3,080	"
Trinidad and Tobago ...	1940	2,870	948	6,000	"
Virgin Islands (British) ...	1940	200	72	160	"
Virgin Islands (United States) ...	1940	405	186	616	"
Greenland ...	1937	...	...	6,678	Exports only
Mexico ..	1940	...	2,195	155,141	1941 production reported at 109.98 million pounds valued at 4,990,029 dollars
Newfoundland ...	1937	34,458	...	450,000	Quantity excludes whales and seals
St. Pierre and Miquelon ...	1942	...	144	1,638	Salted green fish only
United States and Alaska	1940	124,795	71,810	4,059,524	1943 production estimated at 4,000 million pounds, valued at 180 million dollars
TOTAL, North American countries ...	...		...	5,931,477	

	1940	2,000	824	121,122	1942 production reported at 126.8 million pounds; fishermen and craft for 1933
<i>South America</i>					
Argentina ...	...	...	...	134,252	Fishermen and craft for 1938; 1943 production estimated at 176 million pounds
Brazil ...	...	80,002	31,300	...	Estimated
British Guiana	...	692	384	500	"
Chile ...	...	5,617	2,410	70,869	"
Colombia ...	...	...	...	3,500	"
French Guiana	...	...	...	1,792	"
Peru ...	...	6,568	2,404	26,097	Fishermen are for 1940; 1940 production reported at 7.3 million pounds
Surinam ...	...	...	...	3,748	Estimated
Uruguay ...	...	313	...	6,677	
Venezuela ...	...	...	...	100,000	
TOTAL, South American countries	...	...	...	468,557	
<i>Asia</i>					
Arabia ...	1936	...	...	2,003	Exports only
British Malaya	1940	27,069	11,167	196,768	Estimated
Ceylon ...	1935	1,493	6,959	1,800	"
China ...	1939	...	...	2,890,000	Quantity estimated
Chosen ...	1939	...	...	2,300,000	Fishermen and craft estimated
Hawaii ...	1937	4,000	999	19,706	Estimated
India, Iran, Burma	1932	...	...	2,000,000	Exports only
Indo-China ..	1937	...	...	79,638	
Japan ...	1936	1,102,502	366,267	8,107,816	
Kwangtung Leased Territory	1937	305,000	...	132,704	
Palestine ...	1940	1,663	530	3,821	Fishermen and craft for 1941; 1942 production reported at 3.9 million pounds
Philippines ...	1938	...	...	178,055	Exports only
Thailand ...	1935	...	...	44,316	
Soviet Union (Asia only)	1938	...	...	2,127,840	
TOTAL, Asiatic countries	...	...	...	18,084,467	

(Continued on next page)

I. COMMERCIAL FISHERIES OF THE WORLD—Continued

Continent and country		Year	No. of fishermen engaged	No. of fishing craft	Quantity (Thousands of lbs.)	Remarks
<i>Europe</i>						
Belgium	...	1938	1,784	445	86,254	Fishermen and craft for 1936
Bulgaria	...	1940	...	...	15,871	
United Kingdom:	...					
England and Wales	...	1938	...	...	1,711,704	Quantity does not include data on crabs, lobsters, and oysters
Scotland	...	1938	...	...	592,938	"
Ireland	...	1941	8,865	3,137	30,889	"
Czechoslovakia	...	1937	...	...	6,500	
Danzig	...	1931	2,100	811	6,303	
Denmark	...	1940	...	15,350	250,800	
Estonia	...	1935	...	...	40,477	Craft for 1937
Faroe Islands	...	1938	2,530	1,850	55,100	1943 production reported at 22 million pounds
Finland	...	1933	...	...	79,362	Estimated ...
France	...	1937	73,989	23,201	788,400	...
Germany	...	1938	30,000	20,000	1,596,919	...
Greece	...	1937	6,860	2,015	39,537	Fishermen and craft estimated; includes salt-water species only
Iceland	...	1942	5,003	708	740,514	Fishermen estimated; 1938 production reported at 51 million pounds
Italy	...	1937	108,000	42,051	304,000	Fishermen and craft are for 1943
Latvia	...	1932	3,907	524	29,752	Fishermen estimated
Lithuania	...	1938	...	...	5,788	
Maltese Islands	...	1938	1,300	700	2,380	
Netherlands	...	1939	17,570	3,443	350,367	Estimated
Norway	...	1939	115,000	74,580	2,041,620	1942 production reported at 1,500 million pounds
Poland	...	1937	1,822	953	30,822	
Portugal	...	1940	36,837	13,630	260,588	Fishermen are for 1941; 1941 production reported at 403.5 million pounds
Rumania	...	1938	...	...	79,738	1942 production reported at 89.6 million pounds
Spain	...	1940	195,000	40,000	967,252	1943 production reported at 979 million pounds; fishermen and craft estimated
Sweden	...	1939	23,114	20,378	292,866	1941 production reported at 249.4 million pounds

II. COMPOSITION OF THE TECHNICAL COMMITTEE ON FISHERIES

1. In April 1944, Committee "C" of the United Nations Interim Commission on Food and Agriculture established among a number of other committees a Technical Committee on Fisheries. Its first rapporteur, Mr. R. H. Fiedler, resigned on November 1, 1944, to enter the military service, and his duties were taken over by Mr. L. T. Hopkinson. The following have served as members of the Technical Committee :

R. H. Fiedler (U.S.A.), former *Rapporteur*; Chief, Marine Industries Section, Office of Food Programs, Foreign Economic Administration, Washington

Anders Fjelstad (Norway), Delegate of the Royal Norwegian Government for Agricultural Affairs, Washington

D. B. Finn (Canada), *Chairman*; Deputy Minister of Fisheries, Ottawa

Raymond Gushue (Newfoundland), Chairman, Newfoundland Fisheries Board, St. Johns

L. T. Hopkinson (U.S.A.), *Rapporteur*; Chief, Requirements and Allocations Control, Office of Distribution, War Food Administration, Washington

C. E. Jackson (U.S.A.), Assistant Director, Fish and Wildlife Service, Department of the Interior, Washington

Thor Thors (Iceland), Minister of Iceland, Washington

FORESTRY
and
PRIMARY FOREST PRODUCTS

**Report of the Technical Committee
on Forestry and Primary Forest
Products, submitted to the United
Nations Interim Commission on
Food and Agriculture**

April 14, 1945

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INTRODUCTION AND GENERAL RECOMMENDATIONS

1. Food, shelter, and clothing are basic human needs. Dietary requirements for different groups of persons have been established, but there are no comparable standards for shelter and clothing. Variations in climate and tradition may render it difficult to define adequate shelter and adequate clothing with the clarity achieved by the science of nutrition, but it is believed that the number of ill-housed and ill-clad persons approximates the number of ill-fed, and that human beings whose diets are improved usually desire corresponding advances in housing and clothing. This close link between food, shelter, and clothing exists in production as well as in demand. Agriculture not only supplies food, but also most of the materials needed for clothing and housing. Consequently, the consumption program of the Food and Agricultural Organization of the United Nations must go beyond "freedom from want of food." It will be among FAO's functions to ensure that measures stimulating the consumption of the right foods and directing them into proper channels are supplemented by and coordinated with similar national and international action for all other products and resources that come within FAO's scope.

2. Forests are one of these resources. They cover some 22 percent of the earth's land surface (compared with 11 percent for land under cultivation). They are renewable. They are of great significance for agriculture since they can grow on land unsuited to cultivation and provide farmers with additional income, employment, fuel, and building materials from local sources. By checking soil erosion, protecting watersheds and water supplies, facilitating flood control, acting as windbreaks, and offering recreational values and shelter for wildlife, forests in certain locations render significant public services.

3. Forest products can make important contributions to an expanding world economy. Processed by modern techniques, they supply structural materials, synthetic textiles, paper, and many other essentials for the satisfaction of human needs. The increased use of forest products could become a major element in the industrialization of many agricultural areas and of underdeveloped regions; it would create outlets for employment in many countries, promote rural betterment, and stimulate international trade and shipping.

4. Both forests and primary forest products have been included in FAO's scope, because like agriculture and food the two have much to gain from joint consideration. Methods of cutting the crop exercise a decisive influence on the production and renewal of forests. Cutting practices in turn are largely determined by the structure of forest industries and the markets for their products. Hence the consideration of forest management and utilization as two sides of one problem is a technical as well as an economic necessity.

5. These points are discussed in a report on Forestry and Forest

Products¹ which the United Nations Interim Commission on Food and Agriculture has already forwarded to governments. The report also emphasizes the close ties that unite forestry with food and agriculture, defines the range of subject matter, outlines FAO's major functions with regard to forestry and primary forest products, and submits proposals for relations with several international agencies and for FAO's administrative organization in the field of forestry and forest products.² It is the purpose of the present report to examine the need and opportunities for international action after the war and to outline a specific program for forestry and primary forest products.

Recommendations

6. The Committee suggests that the basic objectives of a world forest policy should be :

- (1) The adequate consumption of forest products to improve housing, clothing, and general living standards in all parts of the world.
- (2) The managed use of the world's forests and forest soils for the continuous production of raw materials.
- (3) The conservation of all forests performing important social or protective functions.

In due course governments may wish to consider the adoption of a formal declaration that recognizes the achievement of these basic objectives as a duty to their peoples, to each other, and to the world.

7. In helping to attain the proposed objectives, FAO will necessarily direct its efforts toward a variety of subjects. The Committee recommends that these activities be closely coordinated and geared toward the following more specific goals :

- (1) Application of efficient silviculture and management to all forests in use.
- (2) Afforestation on denuded lands, with particular regard for the needs of portions of Asia.
- (3) Maintenance of protection forests and their extension to meet the requirements of different areas.
- (4) Development of unexploited forests, as rendered possible by economic circumstances.
- (5) Promotion of integrated, modern forest industries.
- (6) Balanced expansion of processing facilities for various primary forest products, in accordance with trends in world demand and the permanent productive capacity of forests.

The achieving of these goals should be accompanied by progressively better incomes and living conditions of forest workers, operators, and owners. Simultaneously, a relative reduction in the cost of forest products should become possible and facilitate their efficient and economical distribution.

¹United Nations Interim Commission on Food and Agriculture, *Third Report to the Governments of the United Nations by the Interim Commission on Food and Agriculture*, Washington, April 25, 1945.

²Since preparing its first report, the Technical Committee on Forestry and Primary Forest Products has assembled recent factual material largely by means of questionnaires; it has also received the following five papers dealing with some outstanding aspects of a world forest policy: *Forest Resources* by J. D. B. Harrison, *Forest Utilization* by J. A. Hall, *Sawmill Products and International Trade* by Gerald Lenanton, *Pulp and Paper* by W. LeRoy Neubrech, and *Principles of sustained Land Use* by W. C. Lowdermilk. The present report is based to a large degree on the information contained in these supporting documents which have been filed with the United Nations Interim Commission on Food and Agriculture.

PART I. NEED AND OPPORTUNITIES FOR A WORLD FOREST POLICY

1. ACTUAL AND POTENTIAL CONTRIBUTIONS OF THE WORLD'S FORESTS

8. It is believed that 30 percent of the earth's land surface was once covered by forests but gradually trees have disappeared from one fourth of that area. The clearing of land has been a necessary part of the spread of civilization but it has involved much ill-advised destruction of forests. On lands best suited for tree growth man will sooner or later have to restore many forests which he once removed.

9. Estimates place the present forest area at roughly 8,000 million acres, but commercial exploitation has hitherto been largely confined to the predominantly coniferous forests of the temperate zone. Those who fear that man has reached his land frontiers should remember that something like 5,000 million acres of forests are almost untouched reserves for future expansion.

10. Some 3,000 million acres of forest land are now accessible and under exploitation. Over two thirds of these forests are either inadequately protected or entirely unprotected against fire, insects, and disease. And while forest management can double and often treble the annual yields from forest lands, effective management is the exception rather than the rule, especially outside of Europe and sometimes even on that continent.

11. Then, too, in the course of harvesting and processing, 60 to 80 percent of the tree substance—all potentially useful—is lost for industrial utilization. As a result of such wastage as well as inefficient protection and production, forests have contributed to human welfare only a small fraction of their potentialities.

2. PRINCIPAL CAUSES OF INADEQUATE FOREST PRACTICES AND UTILIZATION

12. Apparent abundance, inadequate organization of processing industries, lack of knowledge, and failure to safeguard the public interest are the main causes that have led to wasteful and destructive use of the world's forests.

13. To cut only the finest trees, to remove only their best parts, and to abandon the remaining forest requires less knowledge, effort, and equipment than to plan cuttings for many years ahead and to take measures that leave the land in good productive condition. Constructive forest management is a highly technical art which should be handled by trained foresters, but in many countries there are neither enough foresters nor adequate facilities for the training of forest workers and the education of forest owners.

14. A considerable portion of the world's lumber is produced in small sawmills. Very commonly the equipment is crude or the operation of

the mill unskillful. Small manufacturing units, if properly equipped and operated, may be an important factor in good forest management and utilization. Large mills are usually more efficient, but without major adjustment the present structure of the lumber industry does not lend itself to the application of modern technology.

15. In chemical pulp manufacture some 50 percent of the tree substance is lost with the waste liquors. This often creates a serious problem of stream pollution. But over-all yields can be greatly improved by combining the raw-material requirements of the pulp industry with those of the sawmills. At present much of the 3,500 million cubic feet of wood converted annually by pulpmills is still harvested and purchased in competition with the lumber industry. Instead of improving forest utilization, the pulp industry has frequently aggravated forest depletion.

16. These inadequacies have a common cause. Misled by the apparent vastness of the world's forest resources, in many countries the public and industry alike have never seen the urgency of forest conservation. In certain parts of the world—such as China, India, and the Middle East—wood has been scarce for centuries; even in wooded countries temporary wood shortages have been experienced during World Wars I and II. But barring these exceptions the Western world has been conscious of no limitations in its supplies of lumber, pulp, or firewood. It has taken them, like air and water, almost for granted.

17. There were times during the inter-war period when there even seemed to be too much wood, and prices fell to levels at which measures for the perpetuation of forests appeared economically unfeasible. The fact that forests in North America and Central Europe were being severely overcut did not produce the automatic remedy which would appear logical. On the contrary, instead of restricting output, private owners and even governments often tried to compensate for reduced prices by cutting their forests more heavily. Nor did falling prices materially increase the consumption of forest products. Determined primarily by building activity and the production of articles in which the cost of wood is only a minor item, wood demand is quite inelastic in the short run.

18. Even in times uninfluenced by economic depression, wood has been not only plentiful but easily replaced by other equally abundant commodities. Oil and coal are more concentrated fuels than firewood. Concrete and steel have frequently been regarded as the successors to wood in the structural field. In those countries where no law prevented destructive practices, forest owners and industries have usually shunned investment in a crop that requires half a century or more to mature, and have attempted to fight competitive materials with volume production and cheap extraction methods.

19. The disastrous effects of forest destruction are well known, but it is not always realized that damage to forests is easier to forestall than to repair. Poorly stocked, so-called "degraded" stands cannot be used efficiently by modern mass industries working with mechanized logging equipment. Values and yields in damaged stands are often too low to warrant proper forest management by private enterprise. Frequently governments are compelled to take over degraded forests or to use public funds in some other form for their restoration.

3. EFFECTS OF WAR

20. Detailed reports relating to the effects of war on the world's forests are only now becoming available, but enough is known to give weight to the belief that the timber and growing stock in the forests of Europe and the United States have suffered a substantial reduction. The main reasons for such a conclusion are the following :

(1) Land and aerial warfare has inflicted local damage upon European forests. Forest destruction has been most serious in areas of actual fighting operations. In addition, armies need much wood and take it wherever they can find it, regardless of methods of cutting.

(2) Excessive cutting has taken place in almost every country. Rendered necessary by war demands for industrial wood, and especially in order to supply a substitute for other fuel, overcutting has caused more damage than has direct war destruction. But its lasting effects will vary widely. Britain, for instance, has had to make the heaviest sacrifice, while Germany, despite continuous overcutting, since 1934, retains probably 90 percent of the standing volume of her forests. The Germans have helped themselves without restraint to Poland's forests and in smaller degree to those of other occupied countries. In the United States, war requirements have led to exceptionally heavy depletion of highgrade material in some bodies of original timber as well as to overcutting in second growth areas. Consequently, the annual drain has risen to 17,000 million cubic feet, compared with a growth estimated at 11,500 million cubic feet.

(3) Bad forest practices have become common because many skilled loggers went to war and were replaced by untrained men. In Europe especially, manpower shortages led to the interruption of most reforestation and improvement work. This deterioration of forest practices has rendered the damage more severe than figures tend to indicate.

21. To some extent war damage has been offset by reduced cuttings in more remote forests, but while the damage is visible the savings are invisible. It is an open question whether the total cut in continental Europe from 1940 to 1944 was much larger than for the preceding quinquennium. Lack of manpower and transportation, and noncompliance of oppressed populations, have probably limited the losses suffered by European forests to less than had been generally expected. It may even be found that war conditions have not brought Europe's formerly well-managed forests to the serious condition that continuous lack of constructive management has caused in the forests of the United States. But in both Europe and the United States war damage remains sufficiently serious to make forest rehabilitation an urgent task.

22. The reconstruction of war-torn areas and the resumption of house building and other forms of civilian wood use will create an exceptionally large wood demand. The need to replenish exhausted stocks will add substantially to these requirements. In the United States, for example, lumber stocks which normally run around 20,000 million board feet (average annual output, 25,000-30,000 million board feet) have sunk

to an all-time low of 6,000 million board feet ; the British position is presumably worse.

23. Even though in some places facilities might be inadequate, the processing capacity of the world's forest industries is likely to be sufficient to meet postwar requirements. On the other hand, the growing capacity of European and North American forests is likely to be insufficient. Good forest management would call for a temporary curtailment of the annual wood cut to restore depleted growing stock. Because new forests cannot be opened in time, war-weakened forests may be exposed to even heavier drains when the fighting ceases.

24. This is not the only postwar menace threatening the world's forests. The resumption of international trade in forest products will be characterized by many dislocations and changes, though some of these changes will be of a purely temporary nature. For some time the lumber and pulp surpluses of most wood-exporting countries will be smaller than usual and will have to be supplemented by additional shipments from other sources. Europe, previously almost self-sufficient, may be compelled to look to North and South America for heavy wood imports. After meeting domestic postwar requirements, exporting countries wishing to regain their international markets may find that their former buyers are already securing goods from other sources. New industries started under the stimulus of reconstruction requirements may also be ready to enter the international scene. A crisis could result matching in intensity the depression that hit the world's forest interests after 1929. Once again there may occur the paradox of embarrassing surpluses of forest products in the face of progressive forest depletion.

4. THE TURNING POINT

25. World War II has clearly demonstrated the war significance of forest resources. Only a great effort saved Britain from a critical timber famine during the battle of the Atlantic—a famine which might have compelled the closing of her coal mines. Sweden, on the other hand, was able to compensate for the loss of overseas imports by falling back on her forests for fuel, feed, oils, and textiles. Wood and paper shortages have been felt in most countries. These experiences have created a new "forest consciousness" which may greatly facilitate the general adoption of forest management as a necessity and as a public policy.

26. The second major change that will outlast the war is a new concept of wood utilization. It finds its most characteristic expression in three developments :

(1) Discovery that treatment of the inner surface of wood produces structural materials—so-called "wood alloys"—which combine certain qualities of steel, stone, and rubber with those of wood.

(2) Progress in fiber chemistry which opens the whole field of plastics, textiles, and high-grade technical material to pulp and paper products, and permits the economic pulping of almost any wood species and of much sawmill waste.

(3) Establishment of large factories to convert sawdust and other wood unsuited for lumber and pulp into ethyl alcohol, cattle feed, and chemicals. Many chemists regard this as only a beginning; they believe that chemistry will soon produce an industrial method for making liquid hydrocarbons from lignin and other wood waste. By duplicating in minutes what nature took millions of years to perform, science could enable forests to augment the world's non-renewable oil reserves.

27. Meanwhile, progress in the science of forestry is gradually giving man increasing control over the growing of trees. Experiments with trees from suitable strains selected with the help of genetic research have demonstrated that the amount of wood grown annually on an acre of land can be many times multiplied. Experiments have also shown which trees are best suited for particular soils. Skillful cutting can gradually transform existing forests into stands producing higher yields of desirable species. Pruning and other silvicultural devices can adapt growing trees to the requirements of their prospective use.

28. Progress in forest production and progress in forest utilization should go hand in hand. Properly combined, these technical advances can raise the returns from forest land to a point where large-scale growing of forests as a permanent crop may in most countries become a profitable undertaking. Forests now inaccessible because of the high cost of transportation could be opened up; tropical forests composed of hitherto unused species might become a source of chemicals and synthetics; even low-grade woods in countries with poor forest growth might become industrially useful.

29. So far, modern methods have not yet been applied to an extent where their full effect can be gaged. Only 7 percent of the world's annual wood cut is converted into pulp; synthetic fibers claim not quite 1 percent; and the output of integrated forest industries is negligible in world terms. A transformation of forest industries of sufficient proportions to be significant demands heavy investment, capital ready to take risks, and prices sufficiently high to cover losses during initiation and transition. It may be that the reconversion of war industries, urgency of reemployment for millions, and, finally, an exceptional postwar demand for forest products will offer unique opportunities for the introduction of new forest industries on a scale sufficient to change the role of forest products in world economy.

30. If these opportunities are fully used, they will permit and indeed demand a substantial rise in the consumption of forest products even after the period of reconstruction. Such a development is possible. Annual wood consumption ranges from 245 cubic feet per inhabitant in Finland down to 1 cubic foot and less in India and China. It has been suggested that a rise of world wood consumption from its present average of approximately 25 cubic feet to 60 cubic feet per person would be required to provide people on all continents with adequate amounts of lumber, pulp, and other forest products. The consumption goal would probably be even higher if allowance were made for the new products of wood chemistry.

31. However, a sufficiently large and stable rise in wood consumption can be expected to come only as part of an expanding world economy.

Even within such a general trend, an international organization will be needed to assist governments and industries in evolving and coordinating their programs. In the Hot Springs¹ ideals and recommendations and in FAO there is justification for the hope that these fundamental conditions will be fulfilled.

¹These objectives were agreed upon at the United Nations Conference on Food and Agriculture, which met at Hot Springs, Virginia, U. S. A., from May 18 to June 3, 1943. Its *Final Act and Section Reports* were printed by the U. S. Government Printing Office, 1943, as Publication 1948 of the Department of State Conference Series 52. (International documents are published concurrently by a number of the participating governments. Specific citations are given here to the documents as published by the U. S. Government.)

PART II. POLICIES AND PLANS

32. FAO is being initiated by governments representing the majority of the peoples of the world. It will be in a position to help governments coordinate forest policies with agricultural policies, consider the interests of both consumer and producer, and be concerned with the entire field of forestry and primary forest products. FAO will thus be better equipped than its predecessors to assist nations achieve the objectives as well as the more specific goals of a world forest policy already outlined in this report.

33. The Committee suggests that FAO's action for forestry and primary forest products be grouped under the following headings :

(1) Maximum public services and managed use of forests and forest soils through (a) better forestry techniques, (b) economic encouragement of forestry, and (c) public forest policies.

(2) Fullest contribution of primary forest products to an expanding economy through (a) advanced techniques in wood utilization, and (b) adequate consumption and integrated production of forest products.

The remainder of this section is devoted to specific suggestions with regard to each of these groups.

1. BETTER FORESTRY TECHNIQUES

INVENTORY OF FOREST RESOURCES

34. Forestry involves long-range planning upon which no country can engage without a fairly accurate idea of its forest resources. Forest surveys supply this information. Survey methods differ, but all are based on advanced techniques of forest mensuration. Quantitative figures show only part of the picture ; knowledge of the character and composition of forests and information as to the extent and methods of applied forestry are equally important.

35. The original idea of a forest survey was to supply an inventory of forest resources, but as time went on many countries found it convenient to include data on the production and utilization of forest products. Even so, field work requiring specialized skills remains the essence of all forest surveys and gives them the character of a local and technical forestry activity, distinctly different from work with international forestry statistics discussed in paragraphs 62 and 63.

36. Many thousand million acres of forests are still unsurveyed. Inaccessibility is usually the main reason, although certain countries, such as the Soviet Union, Canada, and the United States, have successfully used aerophotogrammetry to obtain the most essential data. Inter-American missions and forestry expeditions organized by several European countries have demonstrated that the exploration of virgin forests hinges essentially on the availability of money, experience, and specialists ; the adaptation of survey techniques to local and even to tropical conditions presents no major difficulties.

Recommendations

37. The Committee recommends that :

(1) All governments undertake to survey their forest resources at regular intervals, and include in their periodic reports to FAO information concerning the progress of these surveys. As a minimum, the surveys might be confined to four groups of facts, namely, area, standing tree volume, annual growth, and annual drain. Each of these terms and their subdivisions must be clearly defined. Some countries, for example, speak of "annual growth" when they actually mean "annual cut." American figures usually refer to net growth after deduction for some natural losses, while European growth statistics include these losses. Subdivisions lend themselves to similar confusion. Should forest area be sub-divided by species or types? Into accessible, commercial, or merchantable timber? Into land of high and low productivity? A meeting of specialists from major countries might be the quickest means of securing international agreement on these points. FAO should submit the conclusions as formal recommendations to governments.

(2) FAO should be in a position to advise countries on the organization of forest surveys. It might designate a panel of survey specialists, and arrange for the services of these specialists at the request of Member governments. FAO should make it possible for interested observers from countries planning surveys to study in the field the survey work actually under way in more advanced countries.

PROMOTION OF SCIENTIFIC PROGRESS

38. The forest is a living community of many mutually interacting organisms, affected by and affecting a complex of environmental factors. An understanding of the life and behavior of forests involves a wide range of natural sciences. This knowledge, which is the basis of scientific silviculture, often leads into new fields of science, such as forest genetics. Tests carried out with hybrid trees in many countries demonstrate that annual yields can be increased several fold through the application of genetics, but it should be remembered that the more spectacular results of these experiments cannot be achieved in large forest areas, and that the planting of hybrids is usually not feasible in a natural forest.

39. The science of forestry relies heavily on results of research carried out in the experimental forests and laboratories of schools and research stations. Because of the long growing period of trees many forestry experiments must extend over many generations. Details about these experiments should be available to research workers of all countries.

40. As early as 1893, the need for international collaboration in forest research led to the creation of the International Union of Forest Research Organizations. Endowed with greater resources and universality, and stronger backing, FAO should assume greater responsibilities than could Union.

Recommendations

41. The Committee recommends that :

(1) FAO should succeed the International Union of Forest Research Organizations as a world clearinghouse of forestry research activities. FAO should seek to ensure full coverage of all research work through up-to-date abstracting services and should promote regular contacts between agricultural and forestry research, which have so much in common in the field of natural sciences. FAO should aid in organizing cooperative plans and research programs among nations and research centers.

(2) It would also appear desirable for FAO to undertake at an early date a world-wide survey of recent progress in the sciences related to forestry.

(3) It should be a function of FAO to stimulate research in tropical forestry. The forest services of several countries (for example, the French, Dutch, Philippine, and Indian forest services) have done considerable research in tropical forestry. Despite these efforts, far too little is known about tropical forests, which differ in many fundamental respects from the forests of the temperate zone. The life habits of all major tropical trees should be studied ; suitable silvicultural methods should be developed and tested.

FOREST PROTECTION AND SILVICULTURE

42. Fire, insects, and disease take continuously an enormous toll of forests, particularly in those areas where systematic management is lacking. The fires that lay waste the forests of Africa, the Soviet Union, and the American continent, and the great losses from infestations by injurious forest insects and diseases in many countries demonstrate the need of forest protection as the first stage in the proper handling of forests.

43. Silviculture is the next stage. Unlike protection, which is preventive in character, silviculture is the constructive art of establishing, improving, harvesting, and reproducing forest stands. It uses a variety of measures such as harvest cuttings to promote natural regeneration, replacement of clear-cut forests by seedlings or nursery stock, and in some cases burning of undesirable brush to ensure reproduction of desired species. Silviculture requires skill based on scientific knowledge of the life habits of individual species including their rate of growth under varying conditions, the value of their products, and the costs of silvicultural practices. The silviculture of pine is different from the silviculture of birch, and both may be practiced in Sweden one way, in Canada another. But despite these differences silviculture is an international art. Certain European countries first developed it ; specialists from these countries later introduced the art to others. Group visits, exchange of students and experts, and international congresses have long been customary among foresters.

44. Great progress has been made in the techniques of forest protection and silviculture, including afforestation. This applies to development of efficient measures of organized work in the field and also the

use of modern equipment, such as radio, airplanes, parachutes, bulldozers in fire control, and special tools and machines for large-scale planting of trees and other silvicultural work.

Recommendations

45. The Committee proposes that FAO should :

(1) Ensure the availability to Member countries of technical information on up-to-date methods and equipment used in silviculture and forest protection.

(2) Assist its members in the formulation of international agreements pledging neighbor governments to cooperate in fire protection, and of sanitary type conventions prohibiting the export of fungus-infested trees and tree products.

46. Afforestation—that is, the establishment of forests on treeless areas—is another aspect of silviculture. After the war, afforestation promises to become particularly important and has been listed accordingly among the more immediate goals of a world forest policy. Small groves of cedar are all that remain of the once famous forests of the Middle East. These forests will have to be restored before the surrounding valleys can again “flow with milk and honey.” Temple forests, exceptionally well managed through thousands of years, testify to the vast forests that once covered the hills of central and southern China. There, as in India and the Mediterranean area, afforestation is indispensable if the living conditions of large populations are to be improved. It is essential not only to provide wood for the people but to conserve the soil that feeds and supports them. Afforestation as a means of accelerating the restoration of war-damaged forests has an important place also in the postwar programs of the more prosperous countries, tying in with their plans for reemployment.

Recommendations

47. The Committee considers that :

(1) FAO should be ready to give technical advice on afforestation and, upon request, to send missions to assist governments in the planning as well as in the execution of major afforestation projects. It may wish to draw up a list of afforestation experts. FAO should keep its Members regularly informed on the progress and results of major afforestation programs. Such information with regard to afforestation projects in regions of the Far, Middle, and Near East would be of special value because, as they proceed, these vast afforestation programs will undoubtedly produce new techniques.

(2) Governments should cooperate in raising the large amounts of seed and planting stock that will be needed for afforestation ; it is of obvious importance that only the best-suited seed and strains be used. Statements about tree-planting programs should be included in the periodic reports by governments to FAO.

(3) FAO should advise and help governments to obtain such seeds, planting stock, and equipment as appear best suited for each case.

- (4) FAO should sponsor the conclusion of an international convention for the certification of tree seeds and stock.

FOREST MANAGEMENT

48. The organization and handling of specified units of forest land for continued production is known as forest management. It is based on a working plan providing for forest protection, roads, and other physical improvements; methods of silviculture; annual cutting budgets; the location and order of harvest and improvement cuttings; and administrative and financial organization.

49. Types of management depend on the character and condition of forests, size and location of properties, and stability of ownership. Generally speaking, public forests offer the most favorable conditions for an intensive type of management, although well-circumstanced private lands are sometimes handled as well or better than near-by public forests. Markets for forest products also exercise a decisive influence. For instance, the age at which trees are cut will be lower for the exclusive production of pulp (cellulose forestry) than for the production of lumber and plywood (sawlog forestry).

50. There is no justification for destructive practices in any country. In newly developed regions forest management may at first be very simple, possibly confined to protection, provisions for replacement after cutting, and safeguarding growing stock. Progressively, more intensive management methods may be introduced, culminating in sustained-yield management to ensure continuous annual crops. The integrated utilization of the forest crop tends to accelerate that process of intensification.

Recommendations

51. Therefore, the Committee recommends that:

(1) The general application of systematic forest management should be one of FAO's major forestry objectives. Responsibility for achieving these objectives through appropriate measures will rest with individual governments.

(2) FAO's functions in the field of forest management—which will be largely advisory—should include the examination of reports from Member governments for the purpose of suggesting measures for intensifying and improving management methods. FAO should also keep Member governments informed as to the extent and types of forest management prevailing in different countries.

(3) Four broad management problems, all of a predominantly regional character, should engage FAO's attention at an early stage:

(a) *Rehabilitation of Europe's forests.* The problem confronting most European governments will be to restore growing stock and forest productivity without interfering with construction activities, and without too much reduction in employment and output within forest industries. Individually nations might not be able to find a solution to the problem; collectively, they might. For some time several European

governments have regulated cutting rates in public and private forests, at times limiting them to 75 percent, and at times prescribing the removal of 150 per cent of annual growth. By advising one another in advance of their cutting programs, and by coordinating these programs over a period of years, it is possible that European governments can overcome some of their postwar difficulties. These governments might wish to organize, with FAO's assistance, a European forestry conference to study that problem.

(b) *Intensification of forest management in the Americas.* In formulating policies to terminate the present process of forest depletion, governments of the Americas should inform themselves of practices and management programs best suited to improve forest production. National studies in the United States, Canada, and a number of other countries have produced some very specific proposals. International review would help to improve these plans in the light of the latest available knowledge. It could provide the starting point for a coordination of national forest programs similar to that suggested for Europe under (a).

(c) *Development of unexploited forests.* Above all, this demands technical exploration and research regarding the habits and life requirements of the more important species. Even though intensive methods of silviculture may at first be impractical, uncontrolled exploitation of virgin forests with no regard for their future value is equally inadvisable. Planned management of specific units may and should begin at once and be gradually extended as conditions permit. Such procedures have not been applied in extensive virgin forests in many underdeveloped regions. In order to assist governments desiring to open up new forest areas, FAO should lose no time in assembling complete data both on the principal undeveloped forests of the world and on the experience encountered in forest development work. Specially trained staff and consultants should be available. Missions should be organized upon request. The appointment of an advisory committee on tropical forests may be found desirable.

(d) *The clearing of forest land.* Throughout time, man has cleared forests destructively. Often he has chosen fire as the simplest method of clearance, giving little thought to the conservation of the resource. Properly organized, the clearing of forests could be combined with the introduction of systematic forest management and with the immediate installation of wood-using industries to provide the new settlers with industrial opportunities. Such a program requires very detailed planning. The time has come to replace crude methods of clearing land with a more modern formula.

(4) In addition to these major regional projects, FAO may wish to organize special studies of management methods suited to small forest units (farm wood lots). It should also undertake a world survey by countries and continents of progress in forest management.

2. ECONOMIC ENCOURAGEMENT OF FOREST MANAGEMENT

COORDINATION OF FORESTRY AND AGRICULTURE

52. Forests provide farmers with income which in some cases enables them to subsist on otherwise submarginal farms. At the same time, the presence of near-by farms, providing a local source of manpower, horsepower, and food, facilitates the operation of forest industries. But forestry and farming supplement each other only if they are properly coordinated.

53. Above all, crops should be suited to the land. Scientific methods of land classification can indicate the soils best suited for crop production, grazing, or forests, respectively. Many governments could benefit from a review of their land utilization in the light of this knowledge. Where evidence of land misuse is encountered, appropriate action should be taken to bring about the necessary changes.

Recommendations

54. The Committee believes that :

(1) The results of national land-use studies should be analyzed by FAO. It could assist governments in the re-orientation of their land-use patterns by providing them with technical advice and specialists. FAO could also assemble data regarding world market trends for alternative products that might be derived from lands for which changes in use are contemplated.

(2) Governments should take steps to protect their forests from destruction brought about by shifting types of primitive cultivation and by excessive livestock grazing. FAO might advise governments concerning adequate measures for the coordination of forestry and livestock economy. In some cases these measures may lead to agreements between neighboring countries designed to keep herds away from both cropland and young forests.

ECONOMIC AND SOCIAL PROBLEMS OF FORESTRY

55. Much forest destruction by industries is due to a widespread misconception that crude exploitation is the most profitable way to handle a forest. Application of forest management may involve curtailment of immediate returns and sometimes add to the cost of cutting and harvesting. But by conserving the forest capital, forest management yields subsequent returns, prevents depreciation of land values, and extends the lifetime of capital investments. Moreover, silvicultural measures are capable of yielding, even in the short run, far greater benefits than is sometimes realized. It will be one of FAO's functions to spread information regarding the profits that proper forest practices can yield. As an initial step, international comparisons might be made of financial returns from forestry.

56. No less significant than economic considerations are the social implications of forestry. In the report of the Committee to the Interim

Commission¹ the disastrous results of forest denudation are emphasized as well as the social instability arising from forest depletion. On the positive side, forests not only are important to agriculture but are capable of offering unique opportunities for the industrialization of some rural areas. The development of hitherto inaccessible forests may lead to the opening up of new land for permanent settlement. Forests, moreover, provide seasonal jobs for farm populations and migratory labor. Recently, the mechanization of forest operations created some unemployment in several Scandinavian forest districts so that the governments concerned were compelled to facilitate and subsidize an intensification of forest management and the establishment of waste-processing forest industries. Progressive stabilization of forest work could contribute materially to rural betterment in several countries.

Recommendations

57. In the opinion of the Committee, FAO should:

(1) Assure full consideration of social factors both in forestry research and in the formulation of forest policies and programs.

(2) Encourage such economic and social research projects as:

(a) *The economic and financial implications of overcutting.* Studies in several European research centers are attempting to devise various measures (for example, compulsory savings, taxation policies) by which forest owners can be induced to set aside as capital gains revenue from excessive cuttings, and apply them instead to cover the subsequent cost of rebuilding growing stock. Continuation of studies along these lines may prove to be particularly helpful in view of anticipated overcuttings during the postwar reconstruction era.

(b) *Postwar employment in forests.* Forestry offers considerable employment possibilities; on the other hand, the development of new forests is frequently retarded by lack of manpower and equipment. Study should be made of the manpower and machinery requirements in different countries and regions for reforestation, development, and afforestation projects.

(c) *Insurance against forest fires by public agencies and private companies (cooperatives included).* Several countries have worked out methods designed not only to protect forest owners against losses but also to effect the gradual reduction of forest fires. These methods have proved to be very successful.

(d) *The effects of integrated utilization on forest management (by continents and countries).*

(e) *Mechanization of forest operations and its effect on cost, labor requirements, and forest management.*

(f) *Living conditions of forest workers; need of and measures for improvements.*

¹United Nations Interim Commission on Food and Agriculture. *op. cit.*, Washington, April 25, 1945.

FOREST CREDIT AND COOPERATIVES

58. In many European countries and in the United States small, frequently scattered forest units comprise as much as two thirds of the private forest area. Their owners are farmers and other individuals who are handicapped in drawing up working plans, in obtaining the services of trained foresters, and in finding adequate markets for forest products. Sometimes these difficulties have been overcome by various more or less formalized methods of collective action. In some countries forest cooperatives handle the management of forests, the purchase of materials, and the harvesting and sale of products; in others they organize the services of logging crews and equipment. In Norway and Sweden, forest owners' cooperatives own and run large industrial installations. They have formed, together with the forest cooperatives of Denmark and Finland, a permanent international organization known as the forest branch of the Central Association of Northern Farmers' Associations. But in many countries practical and legal obstacles still stand in the way of forest cooperatives.

59. Small owners often consent to the clear cutting and depletion of their woodlands because they are in need of cash. The temptation would be greatly lessened if forest-management credit were available. From the bankers' standpoint such credit operations are often facilitated by the fact that a good standing forest constitutes a tangible security.

60. Forest-management credit, designed to facilitate conservation and afforestation, and credit for the development of unexploited forests present two entirely different problems. Development credit usually applies to large-scale projects necessarily involving large investments and often a considerable amount of risk. International credit, granted by capital-exporting nations to less developed countries has played a prominent part in the industrial development of virgin forests. Such credit may well continue to be an essential pre-requisite for the opening up of new forests.

Recommendations

61. The Committee believes that :

(1) FAO, because of its concern for the welfare of farmers, has a special interest in improving forest practices on small wood lots. It should encourage the organization of forest cooperatives and of lending facilities for small forest owners. FAO should study the legal and administrative position of cooperatives in various countries and collect information with regard to the obstacles that stand in their way. FAO should facilitate in every way an exchange of experiences among the forest cooperatives of Member countries.

(2) FAO should act as technical adviser to national and international lending agencies, especially to the proposed International Bank for Reconstruction and Development. In such a role it should be in a position to appraise the technical and economic soundness of forest development projects.

INTERNATIONAL FORESTRY STATISTICS

62. International forestry statistics are wholly inadequate. Information needs first to be developed by governments on a national level.

Forest surveys, which constitute a technical forestry measure, will accomplish much in this direction. They were discussed in Part II, Chapter 1, "Better Forestry Techniques." The present discussion is devoted to the collection, coordination, and interpretation of national forestry statistics. These are international functions and, as such, outstanding responsibilities of FAO.

Recommendations

63. The Committee recommends that FAO should, at the outset, devote its attention to five major statistical tasks in the field of forestry:

(1) Resumption of international forestry statistics.—The International Institute of Agriculture issued forestry year-books and periodical forestry publications which were used by the Centre International de Sylviculture as the basis for further statistical analyses. All such work should be assumed by FAO without delay. It should publish a volume bridging the wartime gap and bringing forestry information up to date. It should then organize a regular intelligence service which would rely on the cooperation of governments, forestry associations, forest schools, and other institutions capable of supplying information.

(2) Standardization of definitions and measurements.—Steps should be taken to clarify by international agreement the meaning of various technical terms. A unification of measurements will scarcely be possible, but their comparability can be greatly improved by establishing conversion units and defining exactly the conditions to which measurements apply. Such a project could be combined with the proposal discussed in paragraph 37.

(3) Improvement of national forest statistics.—In the inter-war period formal proposals with regard to forest statistics were submitted to governments by the International Institute of Agriculture, by a mixed committee of the International Institute of Agriculture and the International Statistical Institute, and by the League of Nations' Committee of Statistical Experts. The Committee recommends that FAO should continue these efforts and suggests that a conference be called to adopt an international program of forest statistics. In establishing the requirements of this program, several types of countries should be differentiated according to the size of forest resources and the stage of their development. FAO should set up a panel of forest statisticians and advise Member countries how to obtain the services of these specialists. Representatives of FAO visiting Member countries should stress the desirability of improved forestry statistics and suggest simple and economical ways to achieve that purpose.

(4) Preparation of a world forest census.—A forest census, repeated at fixed intervals, would result in the compilation of the best available information at a given point in time and indicate major gaps that need to be filled. The announcement of the census might also stimulate various

governments to undertake forest surveys and otherwise improve their national statistics.

(5) Study of the war's effects on forests.—Even before the results of the proposed forest census are available, foresters, industries, and governments will be anxious to know how the war has affected forests in various parts of the world. Therefore, FAO should undertake a preliminary survey by regions or continents. It should coordinate its plan of action with such international programs as that being prepared by the Standing Committee on Empire Forestry which assesses the war's effect on the forests of the British Empire.

(6) Special investigations and studies.—In addition to these broad assignments, FAO might organize some special investigations and studies dealing with: (a) resources and requirements of specialty woods (such world surveys are difficult to combine with the more general forest surveys), (b) annual per acre yields in forests of different regions and countries, and (c) annual forest losses from natural causes, by countries.

3. PUBLIC FOREST POLICIES

FOREST POLICY

64. It has been found that a clear and energetic public forest policy coupled with an extensive system of public forests, can best conserve forests in the public interest and secure general application of constructive forest management. Means used to attain the objectives of public forest policies vary greatly from country to country. They include public ownership of forests, allocation of public funds for forest protection and improvements, public education, legislative regulation of forest management, public cooperation with private owners, taxation measures, and assistance in industrial problems. Another aspect of public forest policies is the designation of forests as protected areas for purposes such as watershed protection, recreation, and the conservation of wildlife. Not all lines of action designed to carry out these policies have been successful, but by process of trial and error several countries have reached fairly satisfactory solutions and have succeeded in striking the right balance between the maintenance of free enterprise and the creation of safeguards for the public interest. As in the field of agricultural production, forestry extension services and other educational measures are winning increased recognition.

65. It is important that all governments adopt progressive forest policies. The declaration by governments, as proposed in paragraph 6 announcing the objectives of a world forest policy, would constitute an important step in that direction.

Recommendations

66. The Committee believes that FAO should :

(1) Assist governments in the planning and application of public forest policies. At an early stage FAO might prepare a statement regarding the different types of silviculture and forest management that should be applied under specified conditions. Such a statement would be of particular value

for countries and regions where proper forest management is new or still in the process of development ; it could serve as a guide in the formulation of public forest policies. Eventually it could be adopted by governments as a standard of forest practices to be achieved and enforced. Indeed, proper forest practices would be greatly facilitated if all countries agreed to observe certain standards and rules for the conservation of their forest resources.

(2) Keep itself and its Member nations well informed about the forms, cost, and results of public forest policies in different countries, and pay special attention to the effect of taxation on the application of forestry. Governments should be requested to include all such information in their periodic reports to FAO.

FOREST ADMINISTRATION

67. The powers and objectives of public forest authorities are a crucial issue in every country's forest policy. Their functions, carried out by provinces, states, and smaller units as well as at the national level, usually include the threefold responsibility of administering and managing the public forests, assuring sound forestry practice on private lands, and promoting forest research and education. The achievement of these objectives involves a number of frequently controversial problems, common to all countries, which would benefit greatly from objective studies and the international comparison of experiences.

Recommendations

68. The Committee considers that :

(1) FAO should endeavour to promote or undertake international studies of such issues as the commercial and industrial activities of public forest authorities, the place of public forest ownership and of public regulation of private forests, the position of forest services in governmental structure, the relation between public and private forest research and education, and national or local regulation of forest management.

(2) FAO's staff and consultants should maintain close personal contact with the forest administrations of all countries. Such contact would be facilitated at the FAO Conference by a regular committee on forestry and forest products. Through sessions of this committee, specialized conferences, and visits of staff members to various capitals, FAO would at all times be kept fully informed about the policies, problems, and organization of national forest administrations. FAO would thus be placed in an excellent position to advise Member nations, when requested, how to establish, reorganize, and expand their forest administrations. From time to time an international digest on public forest administrations might be published.

TECHNICAL FORESTRY EDUCATION

69. In every country, a body of foresters competent to protect and manage forests and to handle technical aspects of forest utilization is both a stimulus to and an essential condition for the proper use of forests and forest soils. The area which a trained forester can manage intensively is subject to definite limitations. Considering this relation between forest area and trained personnel, the number of foresters available at the end of the war is likely to supply only a fraction of technical needs. Thus opportunities will be available to returning servicemen seeking careers that require advanced training.

70. Each country should have facilities for training technical forest personnel or, at least, easy access to training centers. In many countries excellent forestry schools already exist, but in others, especially in less developed countries, an expansion of teaching facilities is needed. International cooperation in forestry education, which already exists to some degree, should be extended.

Recommendations

71. The Committee recommends that FAO should :

(1) Sponsor arrangements for the training of foresters in the schools, camps, and forests of those countries which have achieved efficiency in forest management. Facilities should not be limited to organized visiting tours or to a few months of schooling : rather it should be planned on the basis of prolonged work training.

(2) Make arrangements for outstanding specialists from leading forestry countries to visit the schools and forests of nations where intensive forestry is still in its early phases ; be prepared to advise governments upon request concerning the planning of curricula and the organization of experimental work ; promote the use of films in technical education and act as an international lending center ; and assist in arranging for the exchange or loan of teaching staff. In due course, an international conference of forest schools might be contemplated.

(3) Encourage governments to organize special facilities for training farmers and unskilled men in forestry work. One of the reasons for the prevalence of good forest practices in Scandinavia is a supply of experienced forest workers, permanently employed in definite forest areas and highly trained in craftsmanship from father to son.

4. NEW TECHNIQUES IN WOOD UTILIZATION

PROPERTIES OF WOOD

72. For centuries scientists have studied metals and minerals. Wood, however, has usually been taken for granted and used according to existing traditions. Only recently has the world become conscious of the fact that wood combines a number of unsuspected and even unique physical, chemical, and mechanical properties. The application of this knowledge will produce far-reaching changes in the tra-

ditional methods of wood utilization as well as in silvicultural practices ; but as yet only a beginning has been made.

73. The efforts of the International Union of Forest Research Organizations, the Comité International du Bois, and the International Union of Materials Testing Institutes have led to fairly close international cooperation in fundamental wood research. Organized on an even broader, permanent basis, this cooperation could yield significant results. It could also accelerate the completion of particularly urgent research projects.

74. The need to study and test the properties of little known woods is a research problem of great urgency and importance. In the British Empire, France, the United States, and a few other countries, attempts to develop such knowledge have been made, but many species still remain to be examined. Moreover, tests have frequently been confined to strength and stresses and have neglected the determination of chemical properties.

75. Immediately before the war several programs were under way to establish the strength properties of all woods used in building and for other structural purposes. This step was necessary because insufficient data on permissible stresses had long placed wood at a disadvantage in relation to other more thoroughly explored materials.

Recommendations

76. The Committee recommends that :

(1) A world program should be developed to study the properties of little known woods. -

(2) FAO should establish the closest contact with and among research workers by organizing frequent meetings of specialists, by sponsoring the adoption of joint research programs, and by securing good abstracting services. It should also provide machinery for regular consultation among the major research institutions about projected working and research programs.

(3) FAO should promote the completion of international timber-testing programs. This may involve at an early stage steps to standardize wood-testing methods in order to ensure the comparability of research results. An international meeting of specialists might be considered.

77. Lignin research has been going on for some time in many countries. A coordinated attack on the important problem of lignin utilization could produce solutions which might have significance far beyond the sphere of forest interests.

WOOD UTILIZATION

78. The war has provided a practical demonstration of new methods in wood utilization. The next step is to ensure that the postwar economy of all countries derive full benefit from these experiences.

79. There are five major fields of wood utilization : (1) structural and mechanical uses of wood as wood, (2) modified wood, (3) pulp and fiber products, (4) chemical derivatives and waste products, and (5) solid fuel. Advances made in each of these fields should be coordi-

nated with achievements in the others and with forest practices. Research in the field of secondary forest products can throw significant light on the quality requirements of primary forest products and hence exercise influence on production techniques.

Recommendations

80. The Committee proposes that FAO should :

(1) Become a world center of knowledge of wood utilization. The staff should include an adequate number of experts competent to follow world developments in different technical fields. It might also be desirable to create an advisory committee on wood technology. FAO should see that good abstracting services are available covering the entire field, and it should build up well-classified files and library services for consultation by specialists.

(2) Encourage the revival and expansion of the wood utilization centers that were established during the 1930's in many countries. Concerned in the first place almost exclusively with propaganda promoting the use of wood, these centers gradually extended their interest to research, and organized well-planned campaigns to inform the public on what the forest could do, how forest products should be used, and why forests need to be managed. FAO should assist the various centers in their work by supplying them with publications, data, suggestions, and speakers. It should see that annual wood-utilization conferences continue to be held, follow the more important exhibitions, and use its influence to ensure that exhibits of forest products conform with latest international knowledge. It should also promote national and international measures encouraging inventors to devote increased attention to the field of wood utilization.

(3) Review the progress made since 1938 in the field of wood utilization. Research workers in Allied countries are obviously interested in obtaining details on what steps Germany and other Axis countries have taken since 1938 in the field of wood utilization. Moreover, the exchange of information among Allied countries, and especially between Allied and neutral countries, on technical progress has been restricted by the war. To make its review as complete as possible FAO should send staff members to leading laboratories throughout the world and call on the temporary services of outstanding specialists. A technical conference on wood utilization might prove useful at an early stage.

(4) Promote cooperation among Member governments in the establishment and the use of pilot and demonstration plants. The greatest delay in technical progress arises from the time lag between discovery in the laboratory and the application of new methods on an industrial scale. Pilot plants have proved to be an efficient way of shortening this process, but their building frequently costs more than smaller countries feel inclined to spend. International collaboration of the type recommended has been successful in the past. The pilot plants might be financed by contributions from several countries.

EXTRACTION OF RAW MATERIALS

81. Even in advanced countries logging methods are often very crude. But the recent application of engineering research to logging methods has demonstrated the advisability of making major changes in connection with the introduction of mechanical logging equipment, modern transportation techniques, and harvesting methods that remove from the forest all tree substance suitable for utilization. These modern logging methods hold out possibilities to open up progressively hitherto inaccessible forests.

Recommendations

82. In the opinion of the Committee :

(1) Extension foresters should assist owners and forest workers in improving their logging methods; they should be provided with facilities for the demonstration of new logging methods and equipment.

(2) In addition to acting as a clearinghouse, FAO should draw attention to the advantages of improved logging methods and offer technical advice and assistance to governments. It might draw up a list of logging experts. FAO should also sponsor specialized research for the development of new logging methods and equipment and should encourage case studies of the economics of better logging methods. It should use its influence to facilitate the extension of credit for the purchase of modern logging equipment, to countries that could benefit from its introduction.

(3) FAO should undertake a world survey of forest waste in various countries, regions, and industries, and publish comparative forest-waste studies at frequent intervals.

5. ADEQUATE CONSUMPTION AND INTEGRATED PRODUCTION OF FOREST PRODUCTS

FOREST PRODUCTS—GENERAL

83. If forest products are to make their full contribution to gradually rising living standards, knowledge about consumer habits, and demand and consumption requirements will have to be increased and made more readily available. Governments should study the per caput consumption of forest products, broken down by major uses such as housing, paper, clothing, transportation, and mining. They should also attempt to estimate and influence prospective requirements for each of these categories.

84. Even before the war promising attempts were made in Sweden, the Soviet Union, the United States, and several other countries to determine adequate housing standards for urban and rural populations. In connection with programs to assist displaced persons and rehabilitate devastated areas, the United Nations Relief and Rehabilitation Administration is considering the formulation of minimum shelter requirements. Governments may find it possible to define the amount of floor space, plumbing, number of rooms, and type of utilities with which each citizen should be provided in order to compare existing conditions

with these goals and to formulate long-range building programs accordingly. These plans would constitute a good basis for estimating a country's house-building requirements in lumber, plywood, synthetic panels, structural papers, plastics, and other forest products.

85. Britain's clothing point system, while allowing individuals some freedom of choice, is based on a certain average per caput consumption of dresses, shirts, and other textiles. These techniques and experiences arising from scarcities may prove helpful in planning progressive improvements in people's clothing standards. Similarly, goals might be worked out establishing the paper consumption requirements of a given country for printing, wrapping, and other uses.

86. Ultimately, these studies should be used to establish adequate standards and progressive consumption goals for forest products in general. It might also be found desirable to adjust and balance the requirements of various primary forest products so as to permit an integrated utilization of raw materials and by-products. It is not always realized that a full utilization of the forest crop calls for a certain, although rather flexible, relationship between the output of plywood, lumber, pulp, alcohol, and other products.

87. Many governments will need assistance in organizing consumption statistics. Even more will be anxious to have the advice of specialists with regard to the sociological, economic, health, and other considerations that should be taken into account in establishing consumption standards.

Recommendations

88. The Committee considers that :

(1) FAO should advise governments about measures and policies to secure the gradual achievement of consumption goals and draw attention to the importance of letting the consumer share in the advantages of technical progress. It should analyze national consumption data and technical advances and try to assess present and potential requirements for forest products in various parts of the world.

(2) An up-to-date record should be kept by FAO of the capacity of forest industries in all major forest regions and of forest-industrial programs in all countries. This information should be analyzed, tabulated, and incorporated in an annual report which might be discussed at FAO's annual conference. Advantage might be derived from special international meetings, arranged with the participation of various primary forest industries in order that they may be impressed with the need for an integrated consideration of their programs.

(3) The quantities of raw materials needed for the progressive achievement of consumption goals and for projected expansions of forest industries should be considered in terms of annual forest yields, thus determining by countries, regions, and continents the acreage of well-managed forests necessary to ensure permanent and adequate supplies. Such studies would enable FAO to advise governments upon request whether additional forest production is warranted, and if so about the magnitude and location of such development.

(4) FAO should encourage comparative studies of wood yield and waste in different countries and of reductions in cost and other advantages that could be secured through an integration of forest industries.

LUMBER

89. Sawmills absorb roughly two thirds of all the wood harvested for nonfuel purposes. Lumber output, estimated at 75,000 million board feet (almost 100 million tons) a year, considerably influences forest practices throughout the world, not only because of its quantity but because lumber is traditionally expected to carry the cost of the entire forest operation.

90. Lumber is used mainly in building, crating and furniture making but recently other forest products—plywood, paperboard, and fiberboard—have made heavy inroads on these traditional markets. Despite competition from these and other materials, industrialized nations continue to require annually at least 15 cubic feet of sawlogs per inhabitant, and use many times as much if they are densely forested. On the other hand, wood-exporting countries with low living standards consume only a fraction as much lumber per inhabitant as the more prosperous wood-importing nations. A general rise in living standards might be quickly followed by very much higher lumber requirements in the less developed wood-exporting countries, and compel the lumber-deficit countries to look for new sources of supply.

Recommendations

91. The Committee recommends that FAO should :

(1) Take over as soon as possible the activities of the Comité International du Bois, the organization heretofore concerned with world lumber problems. The services to be assumed by FAO are especially (a) the periodic publication of world statistics and other information on production, stocks, prices, and international trade in lumber ; (b) studies of lumber consumption by uses and by countries; and (c) assistance in organizing technical cooperation among the lumber industries and the lumber-consuming trades of all countries.

(2) Give high priority to a study of prospective lumber requirements in their relation to the forest resources of different continents beginning with Europe and North America. Maladjustments that are likely to occur in international lumber relations during and after the reconstruction era, were mentioned earlier in this report.¹ How such maladjustments could be avoided and whether they are likely to be at all serious can only be determined after careful analysis of facts that have still to be assembled. FAO should also assemble national estimates of reconstruction requirements, and try to find out how big a drop in demand is likely to occur when war damages have been repaired and pent-up demands met. Such a temporary reduction in requirements might be indispensable to enable countries to build up depleted growing

¹ See also earlier quoted reports : *Forest Resources* by J. D. B. Harrison ; *Sawmill Products and International Trade* by Gerald Lenanton.

stock through reduced cuttings over a number of years. These effects will, however, only be obtained if timber-cutting programs and lumber requirements are properly correlated.

(3) Include in its studies (a) a survey, by countries, of the world's lumber-producing capacity as a basis for determining the need to develop additional production facilities, and (b) comparative studies of the costs of lumber production in different countries with special emphasis on raw-material yields and working efficiency. Successful studies of the latter nature have already been made for a number of European countries.

PULP

92. Between 1913 and 1943 world pulp production rose from 3 to 25 million metric tons; even the world economic depression did not interrupt this continuous expansion for more than a year. Annual paper consumption per person still varies between 1 and 300 pounds in different countries. In addition to its use in the manufacture of paper, pulp has become a basic chemical substance for the mass production of textiles, plastics and structural materials. It is safe to assume that there is room for great expansion in world pulp consumption before the saturation point is reached.

93. Most pulp is manufactured in modern factories, owned by large industrial concerns which take full advantage of scientific research and progress—in their factories if not always in their forest operations. Despite its spectacular growth, the pulp industry still processes less than 10 percent of the world's annual wood supply. To achieve a proper balance in the production of primary forest products an expansion of pulp capacity might be desirable, but obviously it should only take place to the extent that pulp consumption can keep in step with such development.

94. No progressive forest policy can be planned without the active participation of the pulp industries. The potential importance of the pulp industry to improved forest management grows as advances in pulp chemistry permit the use of almost any full length fiber, irrespective of the species, defects, and form of the pulpwood.

Recommendations

95. The Committee believes that FAO should :

(1) Offer certain services, previously performed in a more limited way by private international agencies.¹ Services which the industries are anxious to receive include especially the supplying of regular statistics on the production, stocks, prices, and international trade in pulp and the major pulp products.

(2) Study war effects on the pulp-producing capacity of different countries and keep a constant record of subsequent changes. Other studies should be made of consumption trends in pulp and pulp products and of the correlation between

¹ See United States Pulp Producers' Association, *Postwar Policies for the United States Wood Pulp Industry*, New York, December 1944, p. 6.

pulp consumption standards (per caput) and various economic and social conditions.

(3) Sponsor such international research projects as the pulping of wood industries' waste, the pulping of hardwoods (temperate and tropical), and the utilization of waste liquors.

(4) Estimate long-range trends in world supply and demand for pulpwood, and upon request advise governments whether, where, and at what rate new pulp industries should be established and old ones expanded. FAO should also inform governments of steps that have proven helpful in stimulating the consumption of pulp products.

VENEER AND PLYWOOD

96. The ancient Egyptians knew the art of cutting thin slices from logs for decorative purposes, but the mass production of continuous wood layers by peeling logs in large rotary cutters is a modern industrial technique—so is the bonding of these layers with synthetic resin glues. With these methods wood can now be processed into a high-quality material, as demonstrated by its use in airplane and ship construction; it can be molded into desired shapes and serve new purposes for which its favorable weight-strength ratio makes it superior to any other material.

97. In the veneer and plywood industry, mainly high-grade, mature logs of large diameter are used; these are rapidly exhausted and take long to replace. For this reason the veneer industry has been forced to make a choice between frequent changes in its location and expensive imports of heavy logs from distant forests. Research is now under way to lower the size and quality requirements of veneer logs and to develop methods for accelerating the growing of large, clear trees.

98. From the standpoint of good forestry the veneer and plywood industry should cooperate closely with other forest industries that can use logs below veneer grade as well as veneer cores and scrap veneers which are estimated to represent over 50 percent of the log volume. Under such circumstances the veneer industry can be of great service, for by making full use of high-quality wood it helps raise the returns from forest operations to the point where it pays to let trees reach full maturity.

99. The veneer industry, having found that several tropical species (such as mahogany and okoume) supply excellent veneer logs, is more interested in tropical forests than other industries because these forests constitute an immense reserve of large, old trees. Thus in the development of African and Latin American forests, the veneer and plywood industry is likely to continue to be important.

Recommendations

100. It is the opinion of the Committee that :

(1) In addition to the publication of regular statistics covering the raw materials and the products of the veneer industry, FAO should study plywood consumption trends, especially in the light of war experience, to determine the pros-

pective requirements of veneer logs. It should also study the supply prospects of veneer logs from traditional sources and promote the testing of less known species to replace and expand the present supply of suitable raw materials. It should sponsor studies of silvicultural methods for the conservation and reproduction of veneer logs.

(2) FAO should urge governments to encourage cooperative arrangements between veneer mills and complementary primary forest industries.

OTHER PRIMARY FOREST PRODUCTS

101. Tanning extraction, naval-stores production, destructive wood distillation, wood-sugar manufacture, and many other minor forest industries can save from the waste pile materials which sawmills and pulpmills cannot process at a profit. These industries, frequently controlled by chemical concerns and other nonforest interests, could make an important contribution to a well-conceived forest policy if they were properly integrated with other forest industries. The day may come when forest industries processing bark, stumps, sap, and sawdust will match the performance of modern meatpackers in the utilization of their material. Obviously such close utilization is not likely to be possible everywhere.

102. To include these minor forest products in FAO's program would appear particularly appropriate because many minor forest products are of special significance to farmers. Fuelwood, of course, is the outstanding example. In countries where liquid fuel is expensive or in remote mountain regions, wood-gas generators, driving tractors and trucks with a locally available fuel that entails no cash, may become an important factor in farm mechanization. For many farmers, pine resin has significance as a cash crop. Other minor products such as copal, damar, and similar gums deserve FAO's attention as important exports of less developed tropical areas.

Recommendations

103. The Committee believes that :

(1) FAO should gradually develop for each of these minor products the same services it provides for the three leading forest products, namely, world statistics, studies of consumption trends, technical information, and advisory services.

(2) Governments should sponsor the introduction of modern wood stoves in order simultaneously to improve rural living conditions and increase the usefulness of fuelwood. Economic heating devices could make sawlogs and pulpwood now burned as fuel available for more valuable industrial purposes.

(3) FAO should promote international research arrangements to overcome the difficulties still impeding the development of a large-scale wood-sugar industry—an industry that might supply not only substantial amounts of alcohol, liquid motor fuel, and feeding yeast at competitive prices, but also decisively facilitate the achievement of integrated wood utilization.

INTERNATIONAL TRADE IN FOREST PRODUCTS

104. Prior to World War II many large countries were largely self-sufficient in forest products. Fuelwood, which accounts for more than half of the world's wood consumption, seldom crosses international boundaries. For these reasons, 92 percent of the world's wood remained in the countries where it was cut. But the 8 percent that was exported was large enough to place forest products close to the top of the list of internationally traded commodities, and in the Scandinavian countries and Canada, forest industries manufactured chiefly for export in order to meet the wood deficits of the United Kingdom, western Europe, the Mediterranean, and the Far East.

105. At the end of the war, wood exports are likely to increase greatly and become more intercontinental than before. Progressive expansion in the consumption of forest products—proposed as one of FAO's objectives—is likely to stimulate international exchanges, but chemical conversion of low-grade woods might offset some of this expansion by enabling countries to derive from home-grown woods what earlier they were forced to import or else forego. Considering these factors, it appears fairly certain that world trade in forest products will grow—at least in value—and will remain an important item in the balance of payments of many countries.

106. In the inter-war period artificial restrictions interfered with the direction and character of trade in forest products. Tariffs forced Germany's neighbors to ship to her bulky pulpwood and logs instead of processing them on the spot and selling semifinished products. The Scandinavian countries, unable to overcome the barrier of import duties on paper, had to interrupt the production process halfway and sell pulp instead of pulp products. Import quotas, barter agreements, preferential tariffs, and freight rates finally created so much insecurity and disturbance that the producers of pulp, lumber, newsprint, and plywood tried to help themselves by concluding a series of commodity agreements. These agreements had many serious shortcomings and are not likely to be revived. But it is important to forestall and eliminate as far as possible the disturbances that induced producers to conclude these agreements.

Recommendations

107. The Committee recommends that :

(1) Governments should establish national forest-products balance sheets. These should then be collected and correlated for the world.

(2) FAO should remain in close contact with other international agencies dealing with world trade in forest products. It should study the impact of tariff and trade policies on forest management and utilization. It should follow negotiations of trade agreements between countries, and might analyze statements presented in support of tariff protection for forest products. When international commodity agreements for forest products are contemplated, FAO should be ready to advise governments with regard to the aims and consequences of these arrangements.

PART III. RECOMMENDATIONS FOR IMMEDIATE ACTIVITIES

108. The projects proposed in this section have been arranged in two groups. The first comprises activities that might be started at once; the second, projects to be started as opportunities arise and staff facilities permit. In classifying the projects thus, the Committee was guided by three criteria, namely: (1) urgency of problems likely to require the attention of governments in the near future, (2) indispensable preliminary investigations to be completed before major projects are started, and (3) practicability of projects that constitute a resumption of activities previously carried out by the predecessors of FAO.

Recommendations

109. The Committee believes that the first group of projects for FAO's immediate action should comprise the following:

(1) **Rehabilitation problems.** Of these, three are likely to attain great significance as soon as hostilities in Europe cease:

(a) *Lumber situation.* Lumber requirements of various regions for the reconstruction period (1945 to 1950) should be assessed and compared with lumber supplies available for domestic consumption and export.

(b) *Pulpwood situation.* A study should be made of short-term pulpwood supplies and of the existing pulp capacity in various regions and countries; it should be followed by an appraisal of pulp requirements by major categories of products.

(c) *War effects on forests.* This investigation should place special emphasis on the productive capacity of forests by major categories of products (sawlogs, veneer logs, mine props, pulpwood, etc.) and begin with Europe, including the Soviet Union, and North America.

The first step in each of these projects should be to make a compilation of existing information and to study pertinent files from Allied, neutral, and enemy countries. In carrying out the projects, close cooperation with several governments will be necessary; this may lead to the creation of temporary committees of experts and presumably even to the holding of regional conferences and consultations. FAO might also be requested to send missions.

(2) **Regular statistical services.** Arrangements to resume as soon as possible international statistics on forests and forest products should include:

(a) *Statistical definitions.* Preparation of proposals to

establish comparable measuring units and uniform definitions in international forestry and forest products statistics.

(b) *Publications*. An up-to-date yearbook of world timber and pulp trade, containing information on the period since 1937, quarterly publication of data on imports, exports, stocks, production, and prices of lumber, pulpwood, pulp, and plywood; and an up-to-date yearbook of forestry statistics based on the yearbooks of the International Institute of Agriculture, dealing with area, standing volume, annual growth, and annual drain.

(3) *International studies*. The following should be undertaken:

(a) *Progress in forest management*. Information on recent advances in the application of forestry should be assembled in order to compare the extent and methods of forest protection and systematic forest management in different parts of the world. The project should be concerned with both technical issues and public policies. It should include information about existing training facilities for foresters and an estimate of the number of trained persons that will probably be necessary and available at the end of the war. The study should also attempt to show the reductions in annual yields and other deleterious effects that might result from a continuation of present forest practices, and estimate the increases in wood supply and the amount of regular employment that could result from the general application of proper forest management.

(b) *Sciences related to forestry*. A summary is necessary of the progress recently achieved throughout the world in the sciences related to forestry.

(c) *New methods of wood utilization*. The wood utilization experiences of all countries affected by the war should be assembled and analyzed, special emphasis being placed on the peacetime prospects of new methods.

(4) *First world forest census*. Preparations for this census should be initiated as soon as possible.

110. In the second group, the Committee recommends the following projects to FAO:

(1) *Afforestation in the postwar world*. A survey of afforestation projects in different parts of the world should be undertaken as soon as possible. In it special attention should be paid to the potential contribution of these projects to national policies to bring about full employment. A major section of the survey should be devoted to afforestation in the Near and Middle East and China. To accomplish this purpose it might be necessary to send missions to the areas in question. These missions should assist governments not only in determining the size and organization of afforestation projects, but also in solving technical and other difficulties confronting individuals in charge of afforestation programs.

(2) **Inaccessible forests.** After designating the areas covered by the world's largest bodies of now inaccessible forests, information about former attempts to develop these forests should be analyzed to determine in each case the technical and economic difficulties that have to be overcome. As soon as these preliminary studies are completed, FAO might encourage aerial surveys of the forests, tests determining the commercial usefulness of the principal species, and other preparatory steps indispensable to the commercial development of virgin forests. Upon request, FAO should be ready to organize missions to assist governments in these tasks.

(3) **Seed certification.** To serve as the basis for an international convention, general rules should be established relating to the certification of tree seeds and planting stock.

(4) **Wood balance sheets.** Wood balance sheets, for all major countries and for the world (by continental groups) should be established and kept up to date. This project might be facilitated by material that will presumably be found in the files of the Centre International de Sylviculture.

(5) **Implications of excessive cuttings.** (See paragraph 57 2.a.)

(6) **Living standards and wood consumption.** (See paragraphs 83 to 88.)

(7) **Pulp consumption and pulpwood supplies.** Longrange consumption trends in different categories of pulp should be studied and related to such general indices as national income and newspaper circulation. The prospective pulp requirements of different areas should be analyzed, first in relation to local pulp capacity and prospective pulpwood supplies, then in terms of world supply and demand.

(8) **Third World Forest Congress.** The International Forestry Congresses of 1926 and 1936 are regarded by many foresters as landmarks in the history of their profession. While such large congresses are necessarily limited in producing tangible results and action, they provide excellent opportunities for discussion, for taking stock, for making contacts, and for judging the advisability of national or international policies and the prospects for their success or failure. At the end of its initial period of organization FAO might, therefore, find it advisable to convene the Third World Forest Congress at which FAO's program in the field of forestry and forest products could be discussed.

111. The Technical Committee on Forestry and Primary Forest Products desires to emphasize the need for early action. International information on the present status of forests and on requirements and supplies of forest products is far more deficient than the primary source material now available. In the coming months the governments of the United Nations will become increasingly conscious of this gap in their information and will be compelled to take steps to secure some kind of up-to-date picture of the world's forestry situation. If FAO could complete its organization in time to supply such information as would be needed in connection with forthcoming international negotiations and action, it could render a most essential service and win widespread public recognition. This opportunity should not be missed.

APPENDICES

I. COMPOSITION OF THE TECHNICAL COMMITTEE ON FORESTRY AND PRIMARY FOREST PRODUCTS

1. In March 1944, Committee "C" of the United Nations Interim Commission on Food and Agriculture established among a number of other committees a Technical Committee on Forestry and Primary Forest Products. The following have served as members of the Technical Committee :

- D. Roy Cameron (Canada), Dominion Forester, Department of Mines and Resources, Ottawa
Harold G. Champion (U. K.), Director, Imperial Forestry Institute, Oxford University, Oxford
Alpheu Domingues (Brazil), Agricultural Attaché, Embassy of Brazil, Washington
Anders Fjelstad (Norway), Delegate of the Royal Norwegian Government for Agricultural Affairs, Washington
Tom Gil (U. S. A.) Secretary, Charles Lathrop Pack Forestry Foundation, Washington
Egon Glesinger, *Rapporteur* ; Secretary-General, Comité International du Bois, Brussels
Henry S. Graves (U. S. A.) *Chairman* ; Dean Emeritus, Yale School of Forestry, New Haven
Jan V. Hyka (Czechoslovakia), Minister of Czechoslovakia to Mexico, Mexico City
Walter C. Lowdermilk (U. S. A.), Assistant Chief, Soil Conservation Service, Department of Agriculture, Washington
M. A. Menshikov (U. S. S. R.), Deputy Director-General, UNRRA, Washington
P. W. Tsou (China), President of the Agricultural Association of China, Chungking ; Vice Chairman, United Nations Interim Commission on Food and Agriculture, Washington
Jean Vinzant (France), Chief, Lumber and Woodworking Section, Supply Mission for France, Washington
Lyle F. Watts (U. S. A.), Chief, Forest Service, Department of Agriculture, Washington

2. The following have served as alternate members :

- J. D. B. Harrison (Canada), Chief, Forest Economics Division, Dominion Forest Service, Ottawa (for Mr. Cameron)
E. I. Kotok (U. S. A.), Assistant Chief in Charge of Research, Forest Service, Department of Agriculture, Washington (for Mr. Watts)

3. The Committee was also assisted by the following experts :

- Arthur Bevan (U. S. A.), Chief, Paper, Lumber and Container Section, Foreign Economic Administration, Washington

- J. A. Hall (U. S. A.), Senior Biochemist, Forest Service, Department of Agriculture, Washington

Gerald Lenanton (U. K.), Director, Home Timber Production Department, Ministry of Supply, London
W. LeRoy Neubrech (U. S. A.), Chief, Pulp and Paper Unit, Department of Commerce, Washington
William Sparhawk (U. S. A.), Forest Service, Department of Agriculture, Washington

II. SUPPORTING DOCUMENTATION

1. In the following list of supplementary mimeographed reports prepared by the Technical Committee on Forestry and Primary Forest Products, the classifications used are the Committee's code numbers, by which the documents are filed in the Registry of the Interim Commission.

SUBCOMMITTEE ON FORESTRY QUESTIONNAIRE FOR REPORT No. 2, May 30, 1944, Doc. 7, 22 pp.

WOOD UTILIZATION TECHNIQUES, Notes for a Report to the Forestry Panel of the United Nations Interim Commission on Food and Agriculture prepared by members of the staff of the United States Department of Agriculture Forest Service, Forest Products Laboratory, in cooperation with the University of Wisconsin, July 15, 1944, Misc. 16, 80 pp.

SUGGESTIONS FOR A STATISTICAL PROGRAM ON FORESTRY AND FOREST PRODUCTS, August 1, 1944, Doc. 9, 8 pp.

PRELIMINARY ESTIMATES OF FEA'S WORKING GROUP, POST "VE" DAY LUMBER SUPPLY AND REQUIREMENTS (ESTIMATES), November 4, 1944, Misc. 42, 1 p.

PRINCIPLES OF SUSTAINED LAND USE, by W. C. Lowdermilk, November 10, 1944, Rev. Pan. Misc. 9, 27 pp.

RECENT PROGRESS IN WOOD UTILIZATION, Memorandum prepared by Forest Research Institute, Dehra Dun, India, April 14, 1945, Misc. 50, 57 pp.

PRELIMINARY REPORT ON FOREST RESOURCES, by J. D. B. Harrison, January 15, 1945, Doc. 18, 65 pp.

REPORT ON FOREST UTILIZATION, by J. A. Hall, January 25, 1945, Doc. 21, 39 pp.

REPORT ON SAWMILL PRODUCTS AND INTERNATIONAL TRADE (October 13, 1944), by Gerald Lenanton, February 27, 1945, Doc. 22, 15 pp.

REPORT ON PULP AND PAPER, by W. LeRoy Neubrech, January 22, 1945, Doc. 20, 35 pp.

THE FORESTS OF IRAQ, by Darwish Haidari, February 15, 1945, Misc. 47, 8 pp.

And a number of memoranda and special notes.

STATISTICS

**Report of the Technical Committee
on Statistics, submitted to the United
Nations Interim Commission on Food
and Agriculture**

April 7, 1945

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INTRODUCTION

1. The literature concerning the economic and social welfare of the human race is replete with information relating to consuming habits of the various peoples of the world, with reference to plenty and surplus and to hunger and famine. The information is fragmentary as to time and place; frequently it lacks precision and often it is contradictory. More often than not the lack of factual information has delayed the initiation of steps to relieve distress until suffering has reached the acute stage.

2. In like manner volumes have been written on the subject of the relation of supply to price of agricultural commodities. In years of good crops supplies often accumulate while prices fall, or in years of reduced industrial employment demand slackens and crops and live-stock remain unsold. Circumstances such as these have led to concerted attempts by farmers' groups and by nations to control production, to accumulate stocks in good years for sale in the lean years, to feed the market, or even to reduce burdensome supplies by "dumping". One conclusion that may be drawn from the results of these programs is that national programs seldom can be conducted without international reactions.

3. The United Nations have agreed upon a common obligation to raise the levels of nutrition and standards of living, to improve the efficiency of agricultural production and distribution, to better the condition of rural populations, and to cooperate so far as may be possible with other nations for the achievement of these ends. The high purposes of the nations in establishing the Food and Agriculture Organization of the United Nations can only be served if policy and operation both have a firm foundation of factual information. At any given time it would be impossible to advise upon steps which might be taken looking to the improved utilization of food without a knowledge of the supplies of food throughout the world. If agricultural production programs are to be appraised as to their suitability for accomplishing desired ends, the appraisal must be made in the light of reliable statistical background. In so far as possible, the fundamental statistics should be uniform as to definition, adequacy, and precision in the several countries of the world for which the appraisal is undertaken. Again, if an appraisal of food requirements is under consideration, it is essential that there be uniformity of definition and approach to the establishment of the statistical background. International understanding of problems of forest and timber conservation and the development of the resources of the sea and of the inland waters likewise call for acceptable factual information concerning these industries.

4. As a consultative and advisory body, FAO will frequently examine and make recommendations relating to proposed programs for international cooperation in the fields of food, agriculture, fisheries, and forestry. Any such programs involving changes in production

plans, commodity arrangements, the transfer of surplus agricultural commodities to deficit areas, or relief measures with respect to food shortages must be considered in the light of available statistics, not only of production and consumption but of corollary fields. The proper determination of steps to be taken must involve the study of statistics of international trade, availability of processing establishments, marketing facilities, farm management practices, and credit facilities. Only by providing a sound statistical service may an organization such as FAO function effectively and in time. So often the relief of famine has been "too little and too late." While the public is disposed to look with favor upon the administrators of public measures who attempt difficult tasks and do them conscientiously and faithfully, it is not disposed to condone bungling, or poorly conceived or misdirected programs. FAO's permanent, successful role in international affairs is dependent upon the confidence of nations and of all peoples that the organization's policies are sound and that its activities are effectively conducted toward the common good.

5. International collaboration is not new in the field of statistics of agriculture, food, fisheries, and forestry. The International Institute of Agriculture (I.I.A.) has prepared and published agricultural statistics reports since 1908, forestry statistics since 1926. Certain activities of the League of Nations since the early 1920's have been concerned with the statistics of nutrition, agricultural production, and international trade. The International Labour Organisation (I. L. O.) has concerned itself over a like period of time with agricultural labor and wages, with food prices, and with certain phases of nutrition and consumption, as part of its general activity in the over-all field of labor statistics. The International Institute of Statistics devoted some attention to agricultural statistics. The Comité International du Bois (C. I. B.) was active in the field of forestry statistics, particularly in international trade, from 1932 to 1939. The Centre International de Sylviculture (C. I. S.) did some work beginning in 1939. The North American Council on Fishery Investigations has stimulated improvement in fishery statistics from its formation in 1921. The Council for the Exploration of the Sea has acted in an international capacity for Western Europe since 1902 and has published annual statistical reports for many years.

6. Because of the broad scope of its contemplated interests, including as these do the fields of nutrition and of forest and fishery products, as well as of production and trade in agricultural commodities, FAO will be engaged in activities which in part will be parallel to those carried on by other international organizations. It is improbable that the governments would favor concurrent and overlapping activities. It follows that some forms of amalgamation or collaboration will need to be evolved. Because statistical programs call for frequent requests to governments, collaboration in the field of statistics is imperative.

7. The Committee has prepared its report on a number of premises with respect to the statistical program. It has assumed that FAO will be one of a number of international organizations each with its specific field of interest and that the statistical functions of the organizations will follow the general responsibilities. The Committee assumed also that there will be the fullest cooperation between different

organizations that collect statistics on an international plane in the postwar world. Where common interests exist, duplication of work would be avoided by means of collaboration among agencies, in which consultation would be had with the Economic and Social Council of the United Nations organization. For example, FAO would be responsible for collecting and publishing data on agricultural production and food supplies, while it would look to the labor organization for the provision of data that it required on labor and wages; in the field of nutrition certain aspects would fall within the field of FAO, while others would be the primary concern of an international health organization. FAO would provide such other organizations with the statistics they need in FAO's field, and it would expect to be furnished by them with the data it requires for its own purposes.

8. The Committee assumed further that it would be essential to secure some unification of international statistical work and that suitable arrangements would be made by FAO on the one hand and the I.I.A. and the forestry and fishery organizations on the other. Because the contemplated field of work of FAO is more comprehensive in subject matter and in international coverage, it seemed logical that the statistical work of the I.I.A. and the forestry and fishery organizations would be brought into the statistical program of FAO. The relations of FAO to the I.I.A. are to be made¹ the subject of a special report by the Interim Commission; hence the committee considered it unnecessary to do more than call attention to the relationships that partake of a statistical nature. Since the fishery organizations are active only in certain contiguous areas, it seems logical that these might assume regional activities in cooperation with the world-wide activities of FAO. A resumption and expansion of the statistical work of the forestry organizations should be an integral part of FAO's program.

9. FAO will find it imperative to emphasize its statistical services from its very inception. Immediate steps will need to be taken to initiate the assembling on an international scale of information concerning agricultural production, trade in food and other agricultural products, food consumption, and corollary statistics dealing with the abilities of the nations to produce and distribute these products. In the field of food consumption there is need not only for statistics concerning the total annual consumption of foods for the several countries as a whole, but also concerning the distribution of food among the various groups of consumers.

10. Because the production and distribution of food and other agricultural products touch upon so many other economic activities, FAO will need to have statistical series, not only in its field of primary interest but in allied and supplementary fields. It will call directly upon the governments to supply a wide range of statistical information. For example, statistics relating to agricultural production, primary processing, marketing, and food consumption are of paramount interest. For such statistics FAO should come to be recognized as the world authority. There is a second group of statistics which will be urgently needed but which might better be provided by other international agencies. Examples are data pertaining to population and health. For a third group it is not possible at this stage to judge, since it is not yet known what permanent agencies of international collabora-

¹Since this was written, the Second Report to the Governments of the United Nations, dealing with the I.I.A., has been published.

tion will be developed at the termination of the present world conflict. Early in the establishment of FAO a first delineation must be made of the statistical field of the organization in the light of other organizations then in existence or in contemplation. Such other organizations will naturally have roles to play in international collaboration and, therefore, in the development of international statistics. There should be mutual consultation and collaboration in order that each organization may make its most effective contribution toward the joint needs, thereby avoiding duplication and overlappings of requests to the governments on statistical matters.

11. In the following pages attention is directed to numerous statistical series which will be of value to the peoples of the world and to FAO itself in advising on matters of international policy. Among these are some which are essential to a proper evaluation of food production and distribution and which would need to be made the subject of frequent and continuous inquiry. Others have somewhat lower priorities in importance of subject matter or will be needed less frequently. It is realized that not all of these series can be supplied readily by the nations of the world. At the start some countries may be in a position to furnish very few. In many nations the development of such statistical information may require some time. It may be that some governments will need technical advice and assistance in developing procedures to supply the required information. FAO will need to devise ways and means whereby such assistance may be made available. Unless such aid is given, it may be impossible to compile world summaries of many important aspects of agricultural developments. The program of reports should be viewed as a goal for future development rather than as a program that may be put into operation immediately. All nations should be requested to supply certain minimum information. Requests to governments for certain other reports upon economic and agricultural developments will need to be made only after due consideration of the present development of statistics and the capabilities of the statistical agencies in the several countries.

PART I STATISTICAL INFORMATION NEEDED IN THE FIELD OF FOOD AND AGRICULTURE

1. NUTRITION AND FOOD MANAGEMENT

12. Wartime experience has given convincing proof that sound nutritional policies need to be based on statistical information. Among the many countries that have experienced difficulty in obtaining adequate food supplies during these years, it has been those with good statistical pictures of the nutritional status and needs of every section of the population which have derived maximum advantage from the diminished supplies available. In peacetime many countries will continue to experience similar difficulties in that they will be unable to produce or afford to import a sufficiency of food. For them better utilization of existing supplies will be a vital first step forward, and this requires a basis of statistics.

THE PRESENT SITUATION

13. The study of nutrition and food consumption requires statistics relating to (a) the nutritional status and needs of a population, (b) statistics of food consumption by individuals and groups, and (c) statistics of total supplies moving into consumption. Work in this field naturally involves the use of other statistics, such as statistics of health, distribution of national income, retail prices, food production, processing, and marketing. Some of these, such as health and national income statistics, it is hoped will be collected by other international agencies; others are discussed in later chapters of this report.

14. Nutrition and food consumption statistics are scarce. The meager information that exists was assembled mainly in the inter-war period. In the 1920's and 1930's a limited number of budgetary surveys (inquiries concerning family expenditures) was made. These provided statistics of food consumption of certain population groups. Such surveys were made in the United States in the middle 1930's and again in 1942 of a representative cross section of the population. Similar statistics were obtained in 1936 in England from family budget studies. In the majority of countries, however, none were made or the surveys were based on such small samples as to be of questionable value. Of the larger surveys, only one or two were repeated, thereby providing comparisons through time.

15. Food consumption surveys in the form of dietary studies to ascertain the adequacy of the diet of the population had been made in many countries prior to the war, and have been further carried on in a number of countries during the war. Summaries of the surveys of eighteen countries and their results were reported by the Financial Section and Economic Intelligence Service of the League of Nations in the latter part of 1938. The surveys were of various types and covered various parts of the population. The type of survey method adopted

was usually that which suited the population sector being studied. Different methods were therefore frequently used in the same country. In the principal Australian cities, for example, domestic record booklets were kept by the housewife in a supervised household sample survey, while a motor caravan equipped with a small laboratory was employed in an inland sample survey of school and preschool children not only to ascertain food consumption but also to appraise nutritional status.

16. The inter-war period also saw some attempts at estimating national average consumption of foodstuffs per person for the most part in European and North American countries and in Australia and New Zealand. Some of these surveys covered only a few commodities, and most of them were based on very imperfect estimates of production tested by an inadequate number of cross-checks. Few surveys of nutritional status were published, but considerable progress was attained in the techniques for conducting physical, clinical, and physiological tests.

17. Turning from national to international studies the record is even more meager. The International Institute of Agriculture prepared one document on consumption, the International Labour Office published summaries of budgetary surveys, and the reports of the League of Nations Mixed Committee on Nutrition presented a considerable array of miscellaneous data. No sufficient assessment of the validity or international comparability of consumption statistics was undertaken.

18. During the war progress has been much more rapid. For the United States, Canada, and the United Kingdom carefully documented studies of consumption per person, prewar and in each of the war years, jointly prepared, were published in April and December 1944.¹ A similar study for Australia, and possibly one from New Zealand, are expected shortly. At the same time rather less comprehensive estimates have been made, though not published, of wartime consumption in most enemy and enemy-occupied countries—estimates that may be supplemented by documentary material acquired in the course of liberation.

19. Enough has been accomplished to show that almost all the countries of the Western world are able to build up comprehensive statistical pictures of their food supplies and consumption. By so doing governments would equip themselves for ascertaining how by more efficient and equitable distribution they might obtain for their peoples far more advantageous dietaries from the same total supply of food. In many of these countries much work remains to be done in improving the estimates of production, disposition, and stocks. Obstacles will have to be overcome and techniques modified to suit the circumstances, but the objective stands out clearly and its great usefulness is not disputed. Some governments are already far along the road and can move forward rapidly; others have hardly begun and can proceed but slowly. The goal is the same for all.

¹ Combined Food Board, Special Joint Committee, *Food Consumption Levels in the United States, Canada and the United Kingdom*, Washington, April 1944. (International documents are published concurrently by a number of the participating governments. Specific citations are given here to the documents as published by the U. S. Government).

20. Two points need to be noted. First there is a grave danger that those countries which have advanced their statistical inquiries most under stress of war may, with the relaxation of controls, discontinue the collection of much vital information. In an endeavor to prevent this it is desirable that FAO's unit on food consumption statistics be one of the first organized and that immediate relations be established with governments on this subject. The second point is that the statistical advances mentioned refer to comparatively few countries; there remain vast regions of the world in which little or nothing is known about food consumption. It must be emphasized that until these gaps begin to be filled, however imperfectly, progress toward the Hot Springs objectives¹ will continue to be seriously handicapped.

WHAT SHOULD BE ATTEMPTED

21. First attention should be given to the problems of getting factual information from the countries whose populations are farthest from an adequate diet. These in the main are countries lacking the administrative resources for collecting elaborate statistics. For such countries the compilation of national food balance sheets, however simple, on the lines of the Anglo-North American Enquiry seems impractical if not impossible until the basic data on production and supplies have reached a reasonable level of detail and reliability. There are, however, two practicable ways of obtaining information that should provide sufficient knowledge for action in the next few years. These are (a) nutritional surveys, and (b) budgetary surveys. Both can reasonably be undertaken in less developed countries.

22. Nutritional surveys are systematic physical, clinical, and physiological tests on selected groups of people with the object of revealing dietary deficiencies. While the medical techniques should be the concern of FAO's nutrition bureau, the statistician can advise on selecting the population sample and processing the results.

23. Recent developments in sampling techniques make it possible to prepare reliable estimates for total populations on the basis of data from a small number of persons—at least in countries where census information is available not merely by numbers but also by classification as to occupation, race, religious affiliation, or degree of urbanization. In countries where these data are still lacking, larger samples would have to be chosen and even so the results would have to be considered less representative. Nevertheless, the attempt would be worth making.

24. Budgetary surveys are inquiries into family living expenditures. They provide, among many facts, information concerning quantities of food consumed by selected households. Like the nutritional surveys they should be applied to samples of the population chosen to be representative of all groups within the country. In many cases they ought to be undertaken at two contrasted seasons of the year, since important foodstuffs freely available in summer may be absent in

¹These objectives were established at the United Nations Conference on Food and Agriculture, which met at Hot Springs, Virginia, U. S. A., from May 18 to June 3, 1943. The *Final Act and Section Reports* of this conference were printed by the U. S. Government Printing Office, 1943, as Publication 1948 of the Department of State Conference Series 52.

winter. It has been found that under very primitive conditions, when statistics by households cannot be obtained, a rough measure of consumption per person may be obtained by estimating the food supply of a whole village and dividing by the number of inhabitants.

25. Both nutritional and budgetary surveys require trained personnel, which at present is almost wholly lacking in many countries. There are individuals in most countries, however, capable of carrying on the various enumerating and supervising functions under the proper kind of leadership and after undergoing suitable training. Fortunately the training is not complicated, at least for the budgetary and the simple nutritional survey work. FAO could be extremely helpful to the Member nations in finding qualified instructors, perhaps from other countries, who could assist in developing a staff of workers to conduct such surveys.

26. These surveys, however economically conducted, involve considerable expense, particularly the more elaborate nutritional examinations. This may in practice prove the most serious limiting factor, since it is in the less developed countries that trained personnel and government funds are most limited. Considering, however, the essentially practical as well as scientific character of this type of investigation, FAO might assist in obtaining technical assistance for initiating undertakings of this kind.

27. In regard to these surveys FAO can be of great service to its Members. It can advise in the arrangements for the training of personnel; it can secure from other countries the loan of experts for choosing population samples and for laying out the plan of the surveys; and by experimentation it can work out sampling techniques simpler yet more effective than hitherto. Moreover, it should endeavor to secure comparability between the surveys conducted in different countries and should itself undertake international comparisons and interpretations of the results. Indeed interpretation should become a most important end product of these statistical activities.

28. The governments of all countries, however undeveloped their administrative resources, will wish to undertake both nutritional and budgetary surveys. Surveys of these kinds could be made long before countries have developed adequate systems of estimating over-all crop and livestock production. They need not wait for an agricultural census nor for the establishment of a highly organized administration. In the beginning there will be needed a body of field workers trained for these specific jobs, an elementary sampling scheme, and the simplest possible questionnaire. The results that would emerge from such surveys, although not attaining the most desirable levels of scientific accuracy, would afford very pertinent and sufficiently reliable evidence to justify the initiation of policies for nutritional betterment.

29. In more advanced countries it is legitimate to expect not only the undertaking of nutritional and budgetary surveys on a substantial scale but also some beginnings of the more elaborate dietary surveys which involve a careful measurement and analysis of the food consumed in households, including weighing of stocks and purchases, inquiry into kitchen and table waste, and determination of the nutrients in the foodstuffs actually consumed. Such surveys provide greatly increased knowledge of the actual food-consuming habits of the people and offer increased opportunities for improving diets.

30. National food consumption balance sheets provide first approximations of the relative well-being of peoples as measured in terms of kinds and amounts of foods available per person per year. They require estimates of production, stocks, and disposition and improve in usefulness as these estimates are improved. They are readily susceptible to the making of international comparisons and point the way to needed national efforts to produce food products that are found to be insufficient. The techniques and outstanding problems are widely known, but it is of importance that where such studies have been begun during the war they should be continued. Furthermore there are undoubtedly a few other countries in which these studies could be started soon.

31. The initiation of appropriate surveys, whether for the less or the more advanced countries, raises numerous problems of statistical methodology. At an early date FAO will find it necessary to bring together informed persons to discuss such topics as food classifications and the determination of nutrient conversion factors. Other topics of a more specifically nutritional character have been suggested in the report of the Technical Committee on Nutrition and Food Management.

RELATIONS WITH OTHER INTERNATIONAL AGENCIES

32. There remains much relevant material that FAO will hope to obtain via other international agencies—for example, statistics of population, health, and national income. Such agencies may be asked to make special classifications to throw light on FAO's nutritional problems, e.g., death rates for a selected list of causes, and lists of deficiency and other selected diseases. As soon as practicable a joint committee of FAO and the body or bodies responsible for population and health statistics should be established in order to consider such problems. Moreover, there are certain wide demographic problems which FAO will need to consider and which might best be studied in conjunction with such an agency. Generally speaking, FAO's nutrition and food consumption statistics should be related wherever possible to other economic and social statistics.

33. The International Labour Organisation has had a general interest in the field of nutrition and food consumption, and early undertook work at the international level. It has devoted attention to standards of living, food consumption, nutrition, and many related questions. It has accumulated much experience and has initiated expert conferences on food consumption statistics. Some of these are contiguous to the fields of work of FAO. The field of human effort that touches the primary interest of both FAO and the international agencies concerned with health, labor, trade, and other matters is so extensive that it should be easily possible to work out a satisfactory basis of cooperation between them. It is important that this be done at as early a date as possible in each case and that continued collaboration be carried on in order to obtain for governments and their peoples the maximum beneficial results from their joint efforts.

2. AGRICULTURAL PRODUCTION AND PRIMARY PROCESSING

34. Agriculture is the most important industry in most countries and governments are constantly concerned with problems of production

of food and other agricultural products. Dependable information on production is one of the first requisites for an appraisal of the economic condition of farming and of the level of nutrition. Experience during the present war has emphasized the need for accurate statistics and the importance of having a system of collecting statistics that will provide additional data quickly.

35. The underlying need for statistics of agricultural output has been reflected in the establishment of facilities for their collection over most of the world. The approach is often the taking of a farm census in which production is enumerated after the close of the season. Often provision is made for a current crop and livestock reporting service by which crop progress and current livestock outturn is estimated from reports of trained observers. In many countries both approaches are used, the one supplementing the other. A census provides a comprehensive and detailed picture of the agricultural establishment. A series of censuses shows trends and tendencies. In comparison, a current reporting service gives up-to-date accounts of present and prospective developments, which are useful in reaching decisions with respect to buying and selling, planting and breeding, and in other ways adjusting the farm program to the current situation.

36. Authority for the collection and dissemination of agricultural statistics is found in the basic law of the land in some countries, and enabling legislation has been part of the statutes for many years in others. Provision often is made in national regulations or in the budget. The basic urge for statistics of agriculture is apparent in that they are more universally available than any other, with the possible exception of those relating to population.

THE PRESENT SITUATION

37. Satisfactory statistics of production already exist in some countries. Good progress is being made in others in developing statistics, while in still others, the resources are not available or the techniques have not been developed for obtaining the necessary data. Prior to World War II some statistics of agricultural production were gathered and published by practically every country. The number of commodities for which statistics were available varied widely from country to country, as did the reliability and completeness of the estimates. Differences existed also as to the methods of reporting and as to the timeliness of releasing data. At one end of the scale bi-weekly crop condition reports were prepared in some countries, while at the other end in other countries only annual statistics were published and these appeared in yearbooks a year or two after the crop was harvested. Quantitative forecasts of crop production prior to harvest were available for a limited number of commodities in a limited number of countries, but did not have sufficient coverage to reveal basic world developments for important international crops. Forecasts of livestock production were much less frequently reported, as were monthly statements of slaughter, of milk and egg production, and of dairy products manufacture.

38. In Europe every country prior to 1939 was publishing statistics on agricultural production. Many countries had established excellent systems which furnished timely and accurate information.

The crop-estimating systems of Europe depend much less on sampling than the crop-estimating systems of the Western Hemisphere. In some countries annual censuses of crop areas and livestock numbers are made and yields per acre are estimated from special reports. In others, the country estimates of production are the sums of the community estimates reported by local administrative officials. The latter seldom reflect the actual levels of production and often are poor indicators even of changes in production from year to year. In many European countries the agricultural land surveys provide an actual count of the total area devoted to agriculture and these are commonly used in checking the completeness of the estimates of crop acreages. But as a result of land transfers, changes in cropping, etc., these bases soon become out of date.

39. Quantitative production figures are not published until late in the season in many European countries, but monthly condition figures, along with estimates of area sown, are very helpful in interpreting the probable outturn of crops. In some countries the forecasts of crop production are quite detached from the final estimates of production and often the relationship is not very close. Furthermore, the estimates of production in some cases are not even reconciled with the census data for the same years. In some countries the discrepancy between the census and the estimates of production is quite large.

40. Livestock reporting in some European countries prior to World War II was more complete than in any other part of the world. In Denmark, for example, statistics were published monthly in the greatest detail on livestock products and periodically on livestock numbers. In certain countries, on the other hand, data on livestock numbers are quite incomplete and data on utilization of livestock products are almost entirely lacking.

41. In Asia most countries were publishing some agricultural production data before the war. Statistics in Japan were collected in great detail and are believed to reflect changes in production. China has not had an opportunity to complete the organization of the national crop-reporting agency which it was in the process of establishing. In India the estimates for commercial commodities were well developed but there are large unsurveyed areas on which production is only approximated or assumed to remain unchanged year after year. For Asia as a whole, information on livestock has been very meager. Production of livestock products is not large but some measure of its volume is greatly needed in any appraisal of the overall food situation.

42. For Australia and New Zealand excellent agricultural production data have been published. For North Africa, Egypt, and the Union of South Africa fairly adequate information has been provided on some commodities.

43. Methods of crop and livestock reporting in Canada and the United States are quite similar, and in Argentina crop reporting follows somewhat the same pattern. All three countries provide timely statistics on planted and harvested area and production, including forecasts during the growing season. In Canada and the United States farm use and disposition are reported for most crops. Estimates of livestock numbers are published annually. Semiannual reports and fore-

casts of pig production are prepared and detailed statistics on production of livestock and livestock products, including dairy products and eggs. In Argentina livestock production is gaged largely by slaughter in public abattoirs and the manufacture of dairy products in creameries, condenseries, and cheese factories. However, even in Argentina there are fairly accurate estimates of livestock slaughter on farms and some attention has been given to estimating the production of fluid milk and home consumption of dairy and poultry products, although these are not given annually.

44. In these countries estimates of area and livestock numbers are based upon percentage changes from year to year applied to census bases. Returns are received from a large number of individual farm operators concerning area planted and harvested and concerning numbers of livestock on hand. While the number of returns is large, the sample percentage is small. An even smaller number of farmers report monthly on crop progress, production of milk and eggs, and in season upon unit yields of crops.

45. Most other countries in the Western Hemisphere lack one or more of the prerequisites of an adequate crop reporting system. In many of these, agricultural production is scattered and communication difficult. The number of dependable reporters is small and these are largely in the more commercialized areas. Dependence has been placed on the police force, veterinarians, school teachers, or commercial dealers in agricultural products as reporters of changes in production and none of these have proven entirely satisfactory.

46. The experience of the United States crop reporting service points to the benefits that derive from the preparation of estimates for small areas and subunits. It was not until an organization was set up which divided the country into small enough units so that the problems of estimation in each area could be studied and methods of collection adapted to the peculiarities of the area, that production could be accurately measured. In general, a branch office was set up in each state, and states were divided into subareas in order to obtain units that were more nearly uniform in types of farming and in climatic conditions. At the same time, however, the general planning of the inquiries on production, schedules of release, and the sampling schemes and other methodological techniques have been under a centralized staff. In many countries with federalized forms of government the crop-reporting system now in existence has grown up in state or provincial departments of agriculture and the function of the central department consists largely of assembling and summarizing the statistics. The state estimates often are made more or less independently of each other, and surveys are made at various times and cover various fields of activity. Consequently, country estimates have not been available until the report from the last state or province has been received. During the war, there has been a marked improvement in bringing the data together more promptly in a number of countries, in expanding the volume of statistics available, and in making the reports more uniform for all of the states involved. Much still remains to be done.

47. In some countries, notably many in Africa and Asia, the estimates of production are largely confined to that portion of the commodity entering into trade, i. e., delivered to export markets, processing plants, public slaughterhouses, etc. Crop and livestock products

that are retained on farms for use as food or feed are not reported or estimated, or the same amounts are entered year after year regardless of changes in yields, farm practices, or in farm population. Where agriculture is largely self-sufficing, the quantities of commodities thus excluded from the production estimates are very large. In some of these countries comparisons with the estimates of food requirements, after adjustment for imports and exports, make it appear that the estimates are less than 50 percent of the total productions. While the numerous series relating to processing and trade serve a most useful role in reflecting commercial production, they have not been integrated with other information to develop adequate estimates of total production.

WHAT SHOULD BE ATTEMPTED

48. One of the major tasks of the International Institute of Agriculture was the collection, compilation, and dissemination of information regarding agricultural production. It served as an international clearinghouse for statistical and other information relating to agriculture, and for the formulation of efficient and comparable methods of collecting such data in the adhering countries. A considerable amount of work was done also in preparing and issuing technical brochures of considerable scope and practical bearing upon agricultural statistics, the effect of which was to improve and enlarge the work of agricultural reporting. The effectiveness of its work suffered from lack of analysis of the country data and from delay in publication. Though valuable for permanent reference, most of the statistics were without immediate value and of diminished utility to the adhering governments for policy making or for relaying to their nationals. Furthermore, the statistical reports of the I.I.A. carried an insufficient amount of interpretation of the kind that would increase their intelligibility and bearing upon current problems. While in recent years there has been improvement in this respect, a material expansion in such activities seems to be required to meet the current and prospective world needs.

49. The statistical work of FAO should benefit from the experiences and accomplishments of the I.I.A. and should profit by knowledge of its shortcomings. FAO should go further than the earlier work and develop a statistical service in keeping with the needs of the postwar years. It will need to consider the whole field of agricultural commodities and establish a program of essential statistics after consultation with representatives of the adhering governments. This program should reflect the needs for information of the nations themselves.

50. In the field of agricultural production there are a number of commodities of permanent importance in world trade for which reasonably adequate statistics have been available for many years. On the other hand, there are many commodities, largely used on the farms in the localities or in the countries where produced, for which the actual level of production has never been determined. Yet the relative magnitude in a given year of some of these commodities is often the key to the food consumption situation. The statistical program of FAO, particularly in its long-time aspects, must look forward to the development of proper means for measuring the output of these com-

modities. Thus the over-all program must encompass information for all major food and industrial crops as well as for livestock numbers and livestock products.

51. The production of crops is made up of two components, namely, area (number of fruit trees, etc.) and yield. An estimate of area at time of planting is the first indication of potential production. Thereafter, forecast yields at intervals during the growing season enable the public to keep informed of potential supplies. Livestock production, likewise, is made up of two components: number of producing animals and output per head. Just as in the case of crops, the number at the start of the production season gives the first intimation of potential production. The output per head of milk, eggs, and wool, and the gain in weight of meat animals are equivalent to yields of crops and give token of ultimate production. Monthly production on a small sample of farms, checked against monthly processing returns, have proven most useful in estimating production of livestock products.

52. Statistics of these elements of crop and livestock production would seem to be a minimum requirement. At an early date governments should be requested to furnish reports on these elements for the years just past and to initiate a system of regular reports on them thereafter. These requests should be made with due regard to the ability of the governments to comply. Countries in which statistical services are not in operation or operate only on a minor scale should be encouraged to report such statistics as are available and undertake extensions and improvements as circumstances permit.

COOPERATION WITH WEATHER OFFICIALS

53. In appraising reports of crop progress and in forecasting yield during the growing season, certain meteorological data are valuable. Elements most important for this purpose are records of mean, minimum, and maximum temperature, and precipitation. These are basic to any meteorological report and are more consistently reported than other elements. In most of the world, other than mountain, desert, or other uninhabited regions, some form of organization exists that regulates to some degree the taking of meteorological observations. While many of the statistics have not been published and no international body compiles world-wide weather data, regional compilations are available in a number of places. Under the auspices of the International Meteorological Committee, whose membership comprises representatives of many governments, monthly and yearly long-term mean values for a world network of stations have been published by the Meteorological Office of London. By collaboration and cooperation with such agencies, FAO should have available these basic meteorological facts.

54. In addition to their use in verifying and appraising reports of crop progress, meteorological data will be needed to prepare studies of weather-crop yield relationships. It will be especially important to encourage such studies by the statistical agencies of the adhering nations. FAO should arrange for the summarization of such studies and the distribution of these summaries to the national statistical agencies.

PRIMARY PROCESSING STATISTICS

55. The processed products that utilize the raw materials of agriculture and concerning which statistics will be of value are illustrated by such diverse products as flour, sugar, cotton lint (ginnings), tobacco (sales), vegetable oils and margarine, meat and meat products (including lard), dairy products, dried (and other processed) eggs, canned fruits, vegetables, fish, alcohol, wine, and other alcoholic drinks. Information concerning quantities processed is of special significance where it is possible to obtain statistics of nonprocessed uses of the agricultural commodity, such as consumption at the farm, and thereby build up estimated totals.

56. In many countries some public or private record is kept of the processing or conversion of basic commodities. Sometimes the record is a pure statistical effort like a census of industry or manufacturing designed to provide information for the industry or for the public. Often the statistics are a by-product of some government function, such as taxation or inspection. Occasionally, records usable for statistical purposes are kept by dealers interested in the commodity as buyers, handlers, and shippers. Frequently records of this nature can be developed in point of time and degree of completeness as a result of official interest and cooperation. The reporting of all such series of processing statistics should be encouraged by FAO as supplementary to the estimation of commodity production.

57. In a number of countries little progress has been made in developing national statistics of production and processing. The causes are diverse. In many cases difficulties of obtaining returns, either by enumeration or by sampling, are such as to discourage the national officials from attempting the establishment of a system. In some cases trained personnel are not available in the country, and information concerning procedures in countries of a similar character is not available as a guide in training local officials for the task. To encourage the establishment and improvement of agricultural censuses and reporting systems, FAO should have on its staff or obtain by loan from other countries qualified individuals who can be sent to assist in setting up means to provide adequate and regular statistics.

58. To coordinate further the statistical work of the various countries, FAO should foster frequent regional conferences and occasional world conferences of technical workers in this field.

3. AGRICULTURAL MARKETING

59. A proper appraisal of international movements of food and other agricultural products requires statistics of the underlying market activities. The range of statistics includes those relating to local assembling, processing, transportation, storage, and wholesale and retail distribution. In the United States and certain of the western European countries internal marketing statistics are rather voluminous, but even these do not measure up to desired standards for a full comprehension of marketing activities and costs. Certain classes of statistical series which will be needed are (1) quantities moved through marketing channels; (2) stocks held on farms and at several critical stages of the marketing process; (3) prices at which products change hands at several important levels of marketing; (4) charges for marketing service, in-

cluding transportation rates ; (5) costs of operating marketing agencies ; (6) data on marketing agencies, showing number, organization, and location ; and (7) special statistics dealing with government marketing activities, such as the food-stamp plan in the United States. Such information is important for forest products and fish, as well as for crop and livestock products.

60. Reports of stocks of food and other agricultural commodities have a direct bearing upon the computation of consumption per person. They are an essential segment in statements of national consumption based upon a calculation of supplies and distribution wherein the conventional balance sheet type of comparison is made. Differences in estimated stocks frequently are the connecting link between estimates of production and estimates of consumption. Periodic reports on stocks in all positions in which the products can be stored often result in improvements in the estimates of both production and consumption.

61. During recent years various types of government activities have had a bearing upon the comparability of marketing and price statistics. A proper evaluation of these programs in relation to past and prospective agricultural policy and programs will require a statistical record of their extent and importance. Production and export subsidies of many kinds have played an important role in shaping agricultural production and distribution patterns. Loan programs have been important also. Organized marketing policies developed under governmental or quasi-governmental direction have influenced both production and trade. Among these may be mentioned the Agricultural Marketing Boards (United Kingdom) and the Milk Marketing Agreements (United States). Also listed should be such activities as the price control measures in operation in many countries even before the war, taxes upon food and other agricultural products, tariffs and international trade quotas and other restrictions, and special distribution programs, such as carried on under the United States Stamp Plan and by the New Zealand Internal Marketing Division. FAO should become a clearinghouse for descriptions and statistical measurements of the extent of these activities.

62. Marketing organizations of various kinds compile statistics of their operations which, if made available to national or international statistical agencies, would throw light upon food production and consumption and serve as valuable checks upon collateral data. FAO should encourage governments to compile and transmit such information.

4. PRICES

63. In the field of prices, the three principal needs to facilitate international comparisons appear to be a more comprehensive price coverage, a greater uniformity as to categories of prices, and a better description of prices.

64. Prices change frequently and often radically. For the principal agricultural commodities that move in international trade, there are well-known world and primary wholesale markets. Price quotations are recorded daily and may be developed into daily, weekly, or monthly series. Index numbers of prices of agricultural products and other price indices of interest to farmers were published by the International Institute of Agriculture for twenty-five or more countries. With few exceptions the prices from which the indices were constructed were

wholesale series. Such quotations for specified and representative grades of agricultural raw materials at different stages of the marketing process should be continued. FAO should obtain quotations from national or trade sources, maintain records and publish selected significant series.

65. There is also great need for stimulating national reporting of prices received by primary producers at local markets. Such series at present are available in only a few countries. The quotations should not be limited to those commodities which are important in international trade, but should include also commodities like milk and potatoes which are important in diet.

66. Another group of important price quotations are prices paid by farmers for commodities and services. These are important in measuring farm costs on the one hand and the cost of living on the other. Such statistics are prerequisites of an appraisal of net returns from farming, yet are available in only a few countries. In the United States the index numbers of prices paid by farmers are developed from such price quotations and are part and parcel of the parity index used administratively in the determination of "support" prices.

67. In the field of retail prices, the I. L. O. since 1924 has assembled data on costs of food for the specific purpose of throwing light upon relative real wages. The list of foodstuffs priced covers thirty-seven articles, selected to represent the most important foods in the budget of urban wage earners. The data are gathered for the principal or largest cities in the different countries. Retail price quotations in the small cities and towns have been the subject of inquiry in only a few countries.

68. Index numbers will be needed to provide a summary for each country of prices received by farmers, prices paid for production goods and living goods, and wholesale prices of agricultural products. Direct comparisons of prices between countries are often difficult and inconclusive; on the other hand, index numbers depict trends based upon comparable prices. Among the price indices that FAO will be called upon to furnish to the nations are indices of prices received for agricultural products, indices of prices paid for farm production goods, indices of wholesale prices of agricultural products; and indices of prices paid for elements of the cost of living on farms. In these the interest of FAO appears to be direct. Index numbers of cost of living of wage earners for large and small cities and for rural districts, on the other hand, will be an interest of the international organization concerned with labor. Should there be any danger of overlapping between organizations because of common interest, a division of responsibilities should be worked out.

5. AGRICULTURAL INPUT

69. Farmers are important purchasers and consumers of raw and processed materials which they use in agricultural production and in family living. Millions strong, each an entrepreneur with a continuing turnover of liquid assets, and with an ever-present need for replacements of capital goods, they are important, and often dominant, factors in internal trade even in highly industrial countries. Their influence upon internal trade has its reverberation upon international

trade in these materials. Exchange of information on needs or on markets should lead to better distribution of facilities for production, hence for greater production in the countries where these can be produced to advantage. The "raw materials" countries will need certain types of merchandise and services for their development, but to this end they need to sell their raw materials to best advantage to the industrial countries.

70. A number of the commodities used in agricultural production have been the subject of statistical inquiry over a period of years. Of paramount interest among these are fertilizers, feedingstuffs, machinery (including farm power), and seeds. Some fertilizers are mined, processed, or manufactured for the sole purpose of use as plant food; others are the by-products of the chemical or other industries. Fertilizer ingredients move in national and international trade in many forms and tremendous volume. Statistics of production and stocks are ascertainable from census or trade sources in many countries. FAO should compile and publish reports on this subject. Differential results obtainable from fertilizer use on different soils by different crops are still experimental in coverage and tentatively explored by small numbers of practical specialists. The statistical results need to be compiled and compared on an international basis.

71. Feeding stuffs may be basic materials, such as corn, or the by-products of the milling or oilseed-crushing industries, such as wheat bran and oilseed meal and cake. Like fertilizers, they move in fairly well-defined channels, ebbing and flowing in volume and altering direction in response to shifting requirements and relative price advantages. Many crops may be used either for direct human consumption or for feed. In addition, some are sources of industrial products like alcohol. These commodities play important roles in adjusting agricultural production to food requirements. Domestic statistics concerning production of feed are available in many countries and in foreign trade data quite universally. Statistics of stocks and of utilization for feed, food etc., are to be had in some countries and these are essential to a thorough appraisal of the food situation at any given time. FAO should foster the development of statistical inquiries designed to provide comparable and useful series.

72. Statistics of machinery and mechanized power have been available only in a few countries, and the foreign trade reports have not shown the details necessary for a full appraisal of the significance of international movements. A similar lack of adequate statistical information exists for seeds. For all of these input items, FAO should work out a program of reports for the guidance of those working on problems of production and consumption.

6. AGRICULTURAL LABOR

73. Labor is an important element in the cost of agricultural goods. Under some systems of farming it has a high cost because of the seasonal nature of the employment at productive tasks. The farm labor force is a complex of the self-occupied operator, unpaid family labor, hired help, and the part-time farmer who lives on the farm and works partly or mainly at other tasks. The labor aspect of farming impinges upon or merges with the whole problem of tenancy, of land tenure laws and customs, and of farming systems that have been developed in various parts of the world.

74. The farm is not only a place of business; it is also a locale for living. In many parts of the world the farmer is self-employed and, with his family, constitutes the principal if not the sole labor force. Where the farm unit is small, the operator's labor often provides a bare subsistence; in poor years he and his family are victims of undernourishment and malnutrition. Opportunities for off-farm employment at off-season are scarce or nearly nonexistent. On such submarginal farms the operator's income is meager and his effective demand for goods is low. In such areas a full and true count of the population on farms and a full and true count of agricultural production would provide a realistic picture of the farm labor force and of returns from farming. There are regions of the world or parts of countries, however, where farms are relatively large, where agriculture is carried on as a highly commercial enterprise, and where skilled hired labor is important in the farm production program. In these areas statistics of the labor force are significant and important. Comparable series on employment and wage rates would serve many national needs and would also form the basis for international comparisons in earnings of farm workers. Wages as a cost of agricultural production and earnings as part of the income of the hired segment of agricultural workers are useful statistics in measuring well-being or in any analysis of the agricultural economy.

75. There are a number of agricultural commodities of outstanding importance in international trade which are produced in part under very highly developed commercial farming operations. In some instances this takes the form of the plantation system. Among these commodities are rubber, tea, sugar cane, bananas, and cotton. Special studies will be needed of the labor force, wages, cost of living, and the conditions of work in these enterprises.

76. Employment and labor force statistics in forestry and fisheries for the most part differ in nature from those relating to crop and livestock production. Scope and method for these are more nearly akin to those in the mining and manufacturing industries, and industry censuses are needed to provide basic figures on employment and earnings.

77. The primary statistical benchmarks on agricultural employment have been the national censuses of "gainfully occupied" population. For most countries a census has not been taken since 1940, and in many none has been taken since the early 1930's. Other than census data, limited amounts of information are available on agricultural employment. It is probable that under the stress of war, considerable advances have been made in the last few years in the development of labor force statistics, but for reasons of national security these could not be made public.

78. At the conclusion of World War II, prewar data on the gainfully employed population will be obsolete for many countries because of territorial changes, population losses and redistribution, and marked changes in the industrial occupations of the people. Consequently, the development of agricultural labor statistics in postwar years on an international basis needs to be considered as part of a general program requiring national censuses to provide new benchmarks of populations in relation to material resources and employment opportunities. International collaboration to assure a maximum degree of compara-

bility of national data in terms of industrial and occupational classifications will be needed. The field of interest transcends that of agriculture. Much remains to be done to build upon the beginnings made by other international organizations in this field in recent decades.

79. In the field of agricultural wages a number of countries have published the results of statistical inquiries. In 1934 the I.L.O. published a compilation for twenty-seven countries, representing continuous series from 1927 to 1934; these data were brought up to date in the *Year Book of Labour Statistics, 1943-44*. Many questions relating to adequate and representative coverage were noted. Difficulties of establishing uniformity in quotations of time rates and piece rates were many, and the valuation of prerequisites apart from monetary remuneration meant further complications. A Draft Convention Concerning Statistics of Wages and Hours of Work, including statistics of wages in agriculture, was adopted by the International Labour Conference in 1938, and has been ratified by ten countries.

80. A program on agricultural wage statistics would require as a first step agreement upon and adoption of sampling and reporting techniques suited to conditions in the various countries; at the same time it would provide wage data of a high degree of validity. It would then be necessary to agree upon a list of defined groups of agricultural wage workers for which international data might be reported. In view of the diversity of methods of payment, it would seem that average hourly earnings of specified, well-defined groups of agricultural workers, if collected at periodic intervals of the year, would be more significant and capable of international comparison than a great variety of individual rates. In conjunction with reports of hours worked per week, such rates would facilitate comparisons with industrial wage data.

81. The statistics on agricultural employment and wages will need to be restricted in scope and yet broad enough to measure at least a minimum of common elements in countries of diverse physical, economic, and social conditions. Special adaptations of customary classifications of farm workers will be needed for some countries. The statistics should provide differentiation between bona fide farm operators, the important subgroups receiving a share of the products as their remuneration, the part-time laborer, and the full-time hired farm worker.

82. Because of common interests in the field of agricultural wages and labor, consideration should be given to the establishment of a joint committee of FAO and the international organization concerned with labor to treat continuously with these matters.

7. AGRICULTURAL CREDIT

83. The ownership of land in most countries represents an investment to the owner-operator equivalent to the earnings of many years. Almost universally, ownership is associated with indebtedness of either owner-operator or landlord. Arrangements for credit for land purchases, amortization of principal, renewals, and for interest and charges are grounded in customs of the various countries. Many farmers have need of funds for the purchase of equipment, livestock, and other production goods. In some cases credit is needed even for living costs. Interest and other charges for the use of money are:

important items in the cost of production and in determining the final profits from farming.

THE PRESENT SITUATION

84. Funds used in the agricultural industry come from many sources, governmental, corporate, cooperative, and private. Some individual countries have published fairly satisfactory statistics concerning their agricultural credit organizations. Usually these have been more complete for government or government-sponsored agencies than for private sources of credit. Data on the costs of credit (interest and other charges) have been notably incomplete. This is true particularly in countries where much of the agricultural financing is short-term and from private sources. No systematic effort has so far been made to compile agricultural credit statistics on an international basis. The I.I.A. made special surveys of agricultural credit conditions from time to time, but these reports did not contain consistent statistical series.

85. Numerous difficulties in obtaining full and representative data on agricultural loans and interest rates and charges spring from time-honored reticence on such matters. The debtor is loath to publicize his debt; the lender is loath to acknowledge his earnings, particularly when his rates are high. Often the nominal rate of interest charged is only part of the actual cost of agricultural loans. This holds, not only in the case of merchant credit to farmers, but also in the case of long-term loans, especially loans financed by mortgage bonds.

WHAT SHOULD BE ATTEMPTED

86. In view of the possibility that postwar international programs will call for readjustment in agricultural production, it is desirable that over-all statistics on the trends and volume of agricultural credit should be made available as quickly as possible. This suggests that the statistical activities of FAO be developed in two phases: first, the gathering of such statistics on outstanding agricultural loans as can readily be assembled, which will provide an over-all picture of the trends in agricultural credit expansion and which can be related to other agricultural programs; and, second, the collection of the less accessible data needed for an appraisal of volume, availability, costs, and terms of credit by countries.

87. Several approaches to the collection of data on farm indebtedness are possible. For owner-operated farms, a world census would offer an opportunity for a cross-section view. For certain kinds of credit, the reports of recognized lending agencies would provide an alternate approach. For some segments, a sampling approach offers the only possibility of rounding out the picture of the credit-pattern.

88. Since agricultural credit is only one segment of the financial structure of the nations, FAO activity in the whole field, including the statistics of credit, will need to be worked out in collaboration with the projected International Bank for Reconstruction and Development. In keeping with its objectives in the agricultural credit field, FAO probably will be called upon by individual countries for guidance and aid in developing and improving agricultural credit systems. This task probably will require background surveys of the amounts, terms, and conditions of the outstanding agricultural loans, as well as of the functioning of the credit institutions making such loans. For this purpose certain basic data will need to be obtained from the governments.

To obtain comparability of data as between countries, regional conferences ought to be held, at which the scope of the needed surveys can be clearly outlined.

8. FISHERIES

89. Among the many reasons for desiring an improvement in world fishery statistics are three of particular interest to FAO. First, fish is a foodstuff of considerable nutritive value, and it is, therefore, important to have information as to how much people eat. Second, before the war certain fisheries were beginning to be threatened with exhaustion as the results of overfishing, but the true situation can be established only with the aid of full statistical records of production. Third, as with other foods, improved statistics might make it possible to obviate serious maladjustments that now exist between production and consumption.

THE PRESENT SITUATION

90. Of the three existing international fisheries organizations none cover the whole world and only two collect and publish statistics. The Council for the Exploration of the Sea published every year detailed statistics of the catches in the eastern North Atlantic by all its thirteen member countries. These figures were broken down by locality of capture, type of fish, value, quantity, and type of gear used. The North American Council on Fishery Investigations, though never publishing complete fishery statistics for the western North Atlantic, did publish statistical reports on the cod, mackerel, and halibut fisheries. It also secured improvements in the methods of reporting by its member countries. The International Council for the Exploration of the Mediterranean Sea did not publish statistical reports.

91. There are enormous gaps in the world statistical picture of the fishery industry. For example, the annual catch by China, one of the principal fishing countries of the world, probably is not known to within a thousand million pounds. For many of the waters of the world no production statistics are available at all. The international trade statistics are only partially complete and in no sense comparable, since different classifications and measures are employed. Statistics of quantities actually entering into human consumption are in most countries extremely unreliable, since little is known quantitatively about wastage and nonfood uses.

92. Information on the quantity of each kind of gear used and subdivisions of fish landings according to type of gear is already collected for the eastern North Atlantic, and provides a definite measure of fishing effort, i.e., of catch per haul, per trip, or per day, and hence helps to determine where there is overfishing and to what degree. For countries that have yet to establish fishery statistics this elaboration will be possible only for a few of the more important species.

93. All countries publish some statistics of exports and imports, but it will take energetic activity at the international level over a period of years before these statistics with respect to fish become reliable and comparable. At present a chaotic medley of weights and measures is used. Different countries value the products on different bases and there is much confusion as to true origin and destination. Improved

trade statistics are an essential preliminary to any attempt to secure better adjustments between production and consumption.

WHAT SHOULD BE ATTEMPTED

94. Hitherto no agency has attempted to coordinate for all countries of the world such statistics as exist, or approached governments to discuss reforms that would help to place the figures on an internationally comparable basis. A large task awaits FAO here. A statistical program should be drawn up which is not overelaborate but sufficiently comprehensive to serve these purposes.

95. The first step to be undertaken by FAO should be to make a brief world-wide survey of the available statistical material concerning fisheries and fish manufactures. The next step should be to encourage the governments to fill some of the gaps, taking first those that are most important or most easily filled—unfortunately not always the same.

96. The quality and value of important species landed are of importance. For many less developed countries this will be a difficult request and in some cases will be achieved only after a period of years and the development of suitable methods of recording at ports. For all countries it will involve a review of statistical language with the object of (a) securing a uniform classification of species, and (b) securing not uniformity but comparability between the various weights and measures used. In addition, more governments should attempt to determine statistically, as for example is done by Canada, the disposition of the catch, i.e., the quantities going to the fresh market, to processors, and to industrial users.

97. Statistics of capture by locality are important in studies relevant to the conservation of fisheries. These would be useful also in acquainting fishermen with the location of especially productive grounds. For the North Atlantic the fisheries have been divided into named or numbered zones and records are kept by zones. Similar data are needed for the other fisheries of the world.

98. Statistics of the number of boats and men employed in fishing are needed at intervals. The fishery industry should be included in the projected world census, or more properly be made the subject of a special industrial census taken at about the same date. So far as practicable, boats should be classified by tonnage and type of craft, but in many countries where small sail and rowboats predominate in the fisheries the estimate cannot be frequent or all-embracing.

99. Concerning the workers, such statistics should be collected, by FAO and perhaps other organizations as well, as throw light on their standard of living. A high proportion of the world's fishermen fish as a subsidiary occupation and are not so recorded in occupational censuses. It may well be that these and other difficulties could best be overcome by organizing a special census of the fishing industry at ten-year intervals. FAO in consultation with governments should explore such a possibility.

100. A substantial proportion of the fish catch of many countries is processed into dried, cured, salted, canned, and other fish products. Additional products are fish oils, fish meals, and glue. Both to throw more light on food consumption and to suggest ways of making more

rational utilization of the catch, manufacturing statistics should be developed in this much neglected field. Basic figures would be the quantities of raw materials, processed products, sales, and stocks. Fish-liver oils should be reported in terms of vitamin A and D potency as well as by weight, and industrial use should be distinguished from human consumption.

101. The sources of most of this information will be censuses of production or trade association reports. The governments will wish gradually to improve the comparability of these statistics and FAO can be of service in this task. For a few countries it will mean only minor modifications in census questionnaires; for others comprehensive figures cannot be expected for some time.

102. For calculating nutritional values it is important to work toward a uniform system of measuring fish consumption. At present, attempts to estimate consumption are made haphazardly, some governments basing their estimates on the edible portion of the fish, others on the whole fish, and still others on dressed fresh or processed fish. It is likely that information in this field can best be improved by a double attack, first, on statistics of fish supplies moving into consumption and, second, by actual budgetary surveys of quantities consumed.

103. It will probably be desirable to consult and collaborate with the Council for the Exploration of the Sea because of its present responsibility for international collection of statistics from its member countries. Because of the limited area covered by the council, FAO will have the task of developing statistics for other regions. The problem will need to be attacked in the first instance on a regional basis, particularly since fishermen from groups of countries frequent single fishing grounds.

104. Finally FAO should convene international conferences to secure agreement on such topics as classification of species, the establishment of conversion factors for the weights and measures commonly used and for the measurement of the edible quantities actually going into human consumption, the true origin and destination of catches, and uniform principles for valuing landings and international trade.

9. FORESTRY AND PRIMARY FOREST PRODUCTS

105. It is understood that FAO's main objectives in the field of forestry and forest products will be (a) to promote the growth of forests as a crop by means of sound forest management, and (b) to develop the integrated use of the forest crop, now possible as a result of technical and chemical research. This will mean developing better statistics both as regards forests and primary forest industries.

106. The essential facts that need to be known about forest resources are forest area, standing tree volume, and annual growth. These facts do not usually change greatly from year to year and can be obtained through periodic censuses. Annual statistics on the amount of wood felled and losses by fire and other natural causes are important in connection with supply and consumption statistics and for the determination of the relation between growth and drain in the forest. These are always of government origin and where available are usually supplied by the forest service. Statistics for forest products should supply regular information on output, stocks, consumption, inter-

national trade, and prices for all major categories. Data on employment in logging and primary processing plants would round out the primary statistical picture of the forest industry.

THE PRESENT SITUATION

107. Forest resource statistics are reasonably good for Europe, the Soviet Union, North America, Japan, Australia, New Zealand, and South Africa. Little is known about Central and South America, Africa, Asia, and the Middle East. Some of the published figures are quite unreliable.

108. Many countries only report annual cut in the year of a forest census. Year-to-year statistics were available before the war only for the Scandinavian countries, the Soviet Union, and the more important central and western European countries. In a fairly large number of countries there is a report of the cut only in government-owned forests. The United States, Canada, and large parts of the British Empire frequently make estimates of "commercial cut" on the basis of industrial wood consumption. Such estimates usually do not allow for changes in stocks, nor do they include fuel wood cut, nor that part of the annual cut which is used locally by farmers and wood workers.

109. The chief primary forest industries are the sawmill, pulp and plywood industries. Statistics concerning these industries aid in developing a more integrated use of the forest crop and assist in forecasting demand for the output of forests. The principal statistics needed concern raw materials processed, output of products, consumption of products, stocks, sales, prices, and shipments. These figures could be made available in more or less adequate form for most of those countries which have forest industries. In some cases the data are available in government departments and in other cases trade associations maintain satisfactory records. Fortunately the countries lacking such statistics do not as yet have important forest industries.

110. Statistics of foreign trade in forest products are published by all countries, but until a few years ago they could not be compared or added internationally owing to the diversity of definitions (nomenclature) and measures used. Stocks and sales statistics are of importance in judging market trends; they were published by the Soviet Union, Scandinavian and central European countries, the United States, and Canada. Stock statistics for importing countries were just beginning before the war and related only to the United Kingdom, France, Germany, Denmark and the Netherlands. Consumption statistics are not easily obtained owing to the diversity of end products, but some were available for North American and European countries.

111. The I.I.A. published three single volumes of forestry statistics: Europe (1936), America (1938), and Africa (1942)—that is, Asia and Oceania were excluded. It made no attempt to compare or interpret the data or to develop a regular forestry yearbook. The C.I.B. did considerable work in developing the regularity and comparability of international statistics on timber trade, sales, and prices, and greatly speeded up the process of publication. Just before the war this body also began to assemble statistics concerning forest industries and wood consumption. The C.I.S., after its establishment in Berlin, undertook

considerable processing and interpretation of primary statistical material. Converting all forest products into their round wood equivalent, it began to draw up forest balance sheets by countries on forest products. Accordingly, the first task of FAO in forestry statistics will be to resume the statistical series, which had been developed by the three international bodies and which was interrupted by the war.

112. It is assumed that the statistical work of the three international bodies will come within the program of FAO and that it will be continued and improved.

WHAT SHOULD BE ATTEMPTED

113. The next step will be to build up gradually some statistics for those large areas of the world about which little or nothing is known. FAO might well prepare itself to advise the countries concerned on simple and inexpensive survey methods; in areas such as South America it is important to have estimates, even if rough, of the standing tree volume and annual cut by major categories without waiting for the more advanced techniques of statistical recording to be fully developed. The same applies to the forest industries of these countries.

114. It is important that statistics of forest resources and industries be developed in keeping with the long-time needs of the forest industry as a whole. Numerous series will be available for a few countries and these should be summarized and published by FAO. A world-wide program would be limited at first to a few items of high priority and expanded as the governments are able to comply.

115. A beginning should be made in the collection of information concerning the contribution of forests and wood lots to the shelter and living of farmers and forest dwellers. The approach to this information is likely to differ as to source and method from the approach to information concerning commercial forest output.

116. A forest census, covering all branches of the industry, should be developed by 1950 or as soon thereafter as possible. This should be integrated with the world agricultural census. Information concerning farm forests and wood lots would be a part of the agricultural census; information concerning forest lands and resources would be made the subject of special surveys; while information concerning the forest industries would be part of the industrial census.

117. Continued attention should be directed to the clarification of nomenclature and measures used in the compilation of forestry statistics in the several countries in order that international comparisons may be facilitated.

118. Studies should be undertaken of improved methods of collecting and disseminating information on all phases of the industry, and these should be made the subject of recommendations by FAO to the governments.

119. Consideration should be given to the appointment of a panel of forest statisticians to advise on FAO's statistical program and upon request to consult with government agencies concerning methods of developing their forest statistics.

10. INTERNATIONAL TRADE IN AGRICULTURAL PRODUCTS

120. Nations, great and small, have for many years concerned themselves with the in-and-out movements of commodities. All of them jealously guard their right to control the inflow of goods. Many of them control the outflow. The statistics of international trade are a natural consequence of this solicitude and more statistics are available on exports and imports than on any other international subject.

121. The I.I.A. concerned itself with international trade in agricultural products and the League of Nations with the general field of international trade. The latter organization made technical progress by reason of frequent consultation with its Committee of Statistical Experts.

THE PRESENT SITUATION

122. The statistics of foreign trade published by various countries are voluminous, but all are subject to certain inherent defects. Many difficult problems have been encountered by all those who have dealt with these statistics for purposes of international comparisons. Commodities frequently move through indirect channels between the country of first origin and the country of final consumption. The goods may pass through one, two, or several other countries. For purposes of determining levels of consumption, export statistics should relate to the country of final, rather than of immediate, destination, and import statistics should relate to the country of actual origin rather than of immediate shipment. An intensive study of this problem by the League of Nations, in which an attempt was made to trace the actual origin and the ultimate destination of a number of commodities, brought to light many peculiarities of foreign trade statistics. One conclusion was that import statistics were better indicators of real origin and final destination. It was apparent that certain ambiguities were unavoidable, but that certain improvements could be accomplished by due effort on the part of government officials, exporting concerns, and transportation agencies.

123. Because of the wide diversities of products moving in international trade and their differing importance to individual countries, there are physical limitations to reporting exports and imports in the great detail in which they would be of maximum use. The grouping of commodities frequently poses the problem of combining diverse products, and these frequently have diverse units of measurements. Sometimes over-all figures can be expressed only in monetary values and, therefore, lose much of their significance. Fortunately, most of the food products that enter international trade are less complex in nature and more readily recordable. Numerous questions of classification are involved, however, when a product moves in a number of forms, as in the case of wheat and flour. A contribution toward solving this problem was the League of Nations' "Minimum List of Commodities for International Trade Statistics."¹ The League committee also considered a universal bill of lading for use throughout the world in the interest of uniform procedures and to assist in the de-

¹League of Nations, Committee of Statistical Experts, *Studies and Report on Statistical Methods* (Rev. ed.), Geneva, 1938.

termination of the actual country of origin and the final country of destination.

124. The Inter-American Statistical Institute has had prepared a study of foreign trade statistics with a view to recommending certain improvements in classification, nomenclature, and procedures. Definite recommendations made in that study are worthy of consideration by FAO.

125. Important problems partially solved to date have to do with the distinction between gross and net weights, and the methods of valuation of exports and imports. For commodities measured in bags, barrels, cans, etc., it is important to know the average weight of the contained product. For commodities reported in weight units, it is important to know the proportion of the specific product available from the crude material, for example, the net meat weight from a live animal or the net oil weight from a pound of kernels. While unimportant in the matter of foreign trade statistics *per se*, these conversion factors can become fundamental in evaluating derived consumption statistics.

126. A lack of uniformity still exists in the recording of values of goods moving in foreign trade. In some countries these are expressed in terms of tariff values, in some as market values, and in some as commercial invoice values. These last are particularly useful when they show freight and insurance separately. Since the reporting of commercial invoice values makes it possible to derive prices that are analogous to market prices, these would seem to be the most serviceable for general international use.

WHAT SHOULD BE ATTEMPTED

127. For the purposes of FAO the work of the I.I.A. and the League of Nations should be further developed, looking particularly to the adoption of [a universal bill of lading, the improvement of the itemization and classification of food and agricultural commodities including forest products and fish, the establishment of standard trading units, the systematic recording and tabulation of weights on both gross and net bases, the promotion of the general use of commercial invoices as a basic record for valuation, and the acceleration of publication.

128. In the event that an international trade organization should be established, it would have a primary role in the collection of statistics of international trade in all commodities. Undoubtedly these statistics could be handled more effectively by such a central organization. However, FAO should maintain so close a liaison as to ensure the compilation in adequate detail of statistics of food and other agricultural products, including forest products and fish.

11. LAND UTILIZATION, FARM TENURE, AND FARM MANAGEMENT

129. There are a number of fundamental facts that each nation will wish to ascertain about its agricultural industry. Statistics concerning the use of land for the cultivation of crops, for pasture and grazing, for fallow, for farm wood lots, and for public forests are usually encompassed by periodic censuses. The nations will undoubt-

edly look to FAO for assistance in making a judicious selection of a minimum list of such basic facts for inclusion in the next world census.

130. Lands suitable for development in their natural state and under existing climatic conditions still exist to a limited degree in many regions of the world. In the more densely populated countries, however, new farming land must come largely by the improvement of lands that at present cannot be utilized for agricultural pursuits. Improvements in the form of irrigation or drainage often must be undertaken on a large scale and require large capital investments. As population increases, or nutritional standards improve and consumption of farm products increases, clearing, drainage, and irrigation will be resorted to in order to increase the agricultural output. Adequate statistics of present results from drained and irrigated lands will need to be studied when projects of this nature are under consideration. The available data on these subjects might well be summarized by FAO.

131. The relation of the farm operator and farm worker to the land is a subject of vital concern to the nations. The statistics of farm tenure, studied over a period of years as revealed by successive censuses, throw light upon the progress of national well-being. International comparisons of these data and analyses of them in the light of underlying causes should prove extremely helpful to nations in establishing agricultural policies. FAO should encourage the compilation of statistics of land tenure.

132. Farm management statistics—facts developed by accounting methods from the experience of individual farm operators—have been assembled in many countries by groups of farm people and by government agencies. Their highest use is achieved by that group of cooperating farmers the members of which apply the findings to their personal problems. The results have also been used in the general interest of larger groups through development of solutions to production and distribution problems. The unsatisfactory results of the early work of the I.I.A. in this special field of service suggest the need for thorough reexamination of the objectives sought by (and the means of supporting) accountancy statistics at the international level. The success achieved by participating groups can be commended by FAO to groups in other countries in the hope that the extension of the practice of studying such facts will result in gradual improvement of the statistics in which FAO is more directly concerned.

PART II. ORGANIZATION AND PROCEDURES FOR CONDUCTING THE STATISTICAL WORK OF FAO

1. ORGANIZATION OF THE STATISTICAL WORK

133. The Constitution of FAO provides in Article I that "the Organization shall collect, analyze, interpret, and disseminate information relating to nutrition, food and agriculture." It is essential that FAO as soon as permanently organized set up a statistical unit to accomplish these objectives. This unit would be the main aid to the Director-General in coordinating the planning of statistical inquiries, and in the collection, compilation, and publication of statistical reports. It would originate plans for general statistical inquiries in all fields of work of the organization in collaboration with the other units. It would be responsible for placing the statistical work of FAO on a high plane and would assist the governments of the nations to develop and improve their statistical services. It would provide panels of specialists in the various statistical fields to advise with the governments on statistical programs and procedures. Upon request, it would furnish specialists to visit the national agencies and work on these problems at the national level. It would work continuously to improve the statistical methodology of the organization and of the nations in order that the statistical series promulgated might increase in use and effectiveness.

134. In this capacity, the statistics unit would need technicians specializing in the various fields of work, for example, crops, livestock, food consumption, fisheries, and forestry and forest products. Like all other international organizations, it would also need technicians from a number of governments, who would bring to the work a knowledge of the underlying agricultural conditions of production and consumption in the various regions and a knowledge of languages.

135. The statistical work of the I.I.A. was handicapped by limitations of funds. The small technical staff was barely able to maintain the current routine work. Although a number of statistical treatises were prepared, the staff was inadequate to permit the carrying on of the ceaseless contacts with the responsible officials in the governments by which progress could have been maintained and improvement stimulated. If FAO is to develop its statistical services as they should be developed, steps must be taken to build up a competent statistical staff. It is strongly urged that the statistical unit be adequately financed from the beginning.

136. In order that there may be periodical reviews of progress and recurrent planning of improvements in its programs and procedures, a committee of statistical experts should be selected to advise with the staff of FAO on these matters.

137. To meet the statistical needs of FAO and to provide an

authoritative service on world-wide agricultural statistics, the statistical unit will concern itself with two main categories of information. First and foremost will be the month-to-month and year-to-year recording of agricultural developments, like crop and livestock production, international trade, and food consumption. But the unit should also be equipped and have the necessary staff to plan one-time or occasional surveys on matters of major concern, to work with the governments in carrying out such surveys, and to summarize the results.

138. The statistics unit of FAO will busy itself with a wide variety of statistics expressed in a wide variety of terms and units. While it can and should learn much from the experience of the I.I.A., the League of Nations, and other international organizations, it should also at a very early date make a study of the factors and common denominators needed to make possible the compilation of comparable series. Statistics submitted by the national governments probably will be received and recorded in the units used in the reporting country. Conversion factors should be developed as rapidly as possible. Intensive work should be continued to improve upon these common denominators. In carrying on this project the statistics unit should work in close collaboration with the other units of FAO, with other international agencies; and with representative committees of the adhering governments.

139. Many of these problems will be in fields of specialization for some of which there are at present no universal standards. The assistance of competent national experts in the several fields should be enlisted in developing common elements about which statistical programs may be organized. The need for such study and agreement has been indicated in previous chapters of this report. In addition to weights and measures, understandings need to be reached in the classification and terminology of food nutrients, foreign trade, nomenclature of fish, forest mensuration, etc.

140. The I.I.A. and other international agencies have experienced difficulties in preparing world reports by reason of the slowness of response and vexatious delays that attend formal transactions between governments. The necessary steps need to be taken to speed up the results of statistical inquiries. Foresight in planning with ample advance notice, in so far as possible, of coming requests for information will do much to improve the timeliness of reporting. Furthermore, it should be possible in the light of the present tendencies toward informal collaboration to arrange for direct contact between FAO and national statistical services in the preparation of statistical reports.

141. The Committee has encountered the difficulty that inheres in any attempt to organize the statistics of a specific field, namely, that statistical fields are not isolated but interlocking. Farm labor, for example, is one aspect of the general subject of labor statistics, farm credit part of the financial field, and so on. There is needed a general view of the social and statistical field to determine major, coordinate, and minor interests in overlapping and borderline aspects. A constant liaison should be maintained by FAO with other international agencies in order to work out procedures for coordinating statistical inquiries for the governments.

2. A WORLD CENSUS

142. The need of a world-wide census of agriculture has been

stressed several times in this report. Such a census contemplates a decennial enumeration of farms and farm property, including land, buildings, equipment and livestock inventories, farm population, occupancy and tenure, acreage of crops harvested and livestock products, outturn of forest products from the farm wood lot, and farm processing of basic agricultural products. To provide the full needs of FAO, a concurrent industrial census is required to supply information upon forest resources and timber output, fisheries, and primary processing of agricultural products. Included in the latter would be the statistics of consumption of raw material, production of processed goods, capital invested and labor force.

143. Certain facts of vital importance to an adequate recurring appraisal of agricultural development are obtained by means of periodic enumerations. For example, statistics on size of farms, numbers of farmers, labor supplies, tenure of operators, and farm capitalization provide not only a cross section of the agricultural industry, but also furnish bases for series of recurrent statistics. Moreover, a periodic census provides weights for use in designing sampling procedures and interpreting the results of sample enumerations and other inquiries.

144. The first comprehensive world census project was undertaken in 1924 under the sponsorship of the I.I.A. Many conferences were held and studies made to reach a general agreement on methods and procedures. Statisticians from more than thirty countries attended these conferences and the director of the project got in touch with seventy-five countries on a world-wide tour. When the first census for 1930 was taken, thirty-eight countries and colonies were included and these represented about half the countries of the world of importance in agricultural production.

145. Starting in October 1936, a number of conferences were held at Rome to consider the 1940 world census. Sample questionnaires were drawn up and sent to all countries, together with other materials, urging that the countries join in the undertaking. It appeared in 1939 that important progress would be made, as nearly fifty countries took or planned to take a census during the world census period. Some of these plans undoubtedly had to be dropped as a result of the advent of World War II. Nevertheless, a number of countries did take the census and published the results. A number of other countries probably took the census, but so far have not summarized and released the information. The I.I.A. undertook to publish summaries of these censuses as they appeared. This plan was carried out for six countries by publication in *Monthly Crop Report and Agricultural Statistics* prior to April 1941.

146. The nations will wish to know the status of their agricultural industry as soon as practicable after the close of the war. In planning the taking of a census of agriculture, it is anticipated that they will look to FAO for technical assistance and guidance. In keeping with the past, it is reasonable to suppose that the next world census would be taken in 1950 or as soon as practicable thereafter. It will be none too early to begin active work on such a project as soon as FAO is set up.

147. Information from such a world census will be needed for reconstruction plans and policies. A special census staff in the statistics

unit will need to give full time to this project. To work out methods that will obtain the facts and also to translate and analyze properly the data when collected, competent statisticians will be needed who are familiar with the countries and some of whom have had previous international experience. The special census staff will need to develop and maintain world-wide contacts; in addition, regional and world-wide conferences should be held in order to arrive at comparable inquiries and maintain interest on the part of the countries in continuing with the project.

148. A material handicap in the 1930 and 1940 censuses was the lack of competent personnel and in some countries the lack of national statistical agencies with the background necessary to develop the project. Part of the census staff might well be assigned to consult about census-taking with officials in countries that desire and need such aid. Publicity of results would go far to create international interest in a world census. FAO should collaborate with all countries, irrespective of their membership in the organization, and with other international organizations, in order to obtain comprehensive and truly world-wide results.

3. SOURCES AND USES OF STATISTICAL INFORMATION

149. In keeping with the terms of the Constitution, the Member nations will be expected to provide statistical reports on agricultural production, consumption, etc., for their countries. Within many nations information of a statistical character will originate in several government departments, depending upon the internal organization. In some countries the information will be obtained from central bureaus of statistics; in other countries from departments of agriculture, forestry bureaus, and fisheries bureaus; in still others from bureaus of the census, customs bureaus, etc. All such official statistics will be forwarded to FAO through the foreign offices or directly by the originating agency through procedures approved by such departments. Such official reports naturally will serve as basic material for the preparation of statistical reports by FAO.

150. Many countries, however, may be unable to furnish replies to all of the statistical inquiries undertaken by FAO, at least during the initial years of the organization. Moreover some countries may not be members of FAO. Inasmuch as statistics on a world-wide basis will be most efficacious in providing bases for the determinations of policies of the organization, it will be necessary that FAO obtain certain information from nongovernmental sources. Among such possible sources are industry and corporation reports, trade associations, commercial newspapers and periodicals, and special information supplied by commercial and agricultural representatives of other governments in the countries affected. Upon occasion and subject to invitation it may fall within the province of FAO to send special representatives to conduct surveys by means of personal contacts in the countries for which additional information is needed. There will be times also in which technicians of FAO will be in a position to prepare reliable estimates based upon internal studies. Illustrations of such studies are the estimation of crop yields from corollary weather data and the estimation of acreage based upon acreage trends, and upon plantings in relation to weather and to price.

151. As pointed out in the section on agricultural production statistics, there are frequent delays in the assembling and forwarding of official government reports, delays which prevent the preparation of timely regional and world summaries. If FAO is to develop an informational service for the benefit of all countries concerned, it will need to publish certain basic statistics at regular intervals. Such an activity seems to be a minimum service which it should render in order to merit the continued confidence, cooperation, and support of the adhering governments. The lack of adequate regional or world summaries of agricultural production, consumption, etc., at times will endanger the adoption of adequate policies and operational steps which might otherwise be recommended to remedy a particular situation. It seems logical, in fact necessary, under such circumstances that FAO undertake the preparation of tentative estimates pending the receipt of official figures. For the preparation of such estimates FAO should have technicians who are competent to make careful appraisal of historic data and current information from any and all sources. A liberal operating policy in this regard would do much to overcome the criticisms that were made concerning the work of the I.I.A. A liberal policy of this kind should also do much to stimulate the officials of Member governments to take the steps necessary to supply the estimates promptly in accordance with an announced reporting schedule.

152. The establishment of policy and practices to be followed in the event of disagreement by the technicians of FAO with the official national estimates submitted by the countries will require considered and careful thought. The full and efficient conduct of the affairs of FAO would seem to require a considerable latitude of freedom of estimation by the responsible technicians in utilizing whatever sources of information are available. In an international organization, however, it would be inappropriate to publish estimates for a given country that differ from the official national estimates published or supplied by the government. This would be true even when technicians might have very serious doubts of the adequacy of the official figures. Problems of this nature would be sure to arise in the early years of the organization. It is to be expected that during this period there will be many instances when the official national figures will depart materially from the accepted standards because of faulty procedures such as differences in definitions or in coverage as to area or time. While it would be undesirable to substitute estimates prepared by the technicians of FAO for the official national figures, it would seem that FAO should have a right to express reservations with respect to given figures in footnotes or in accompanying text. Where an official government figure appears very questionable it might be omitted from published reports entirely, pending confirmation or clarification.

153. It is anticipated that upon occasion so little information might be at hand for an important country concerning acreage and production of crops, numbers and production of livestock or livestock products, and similar basic developments in the field of agriculture that FAO would not feel justified in publishing any figure whatsoever. At the same time there might be urgent need for regional or world totals for publication or for the determination of policy. Under these circumstances, FAO should be free to establish regional or world totals, utilizing nonpublished approximations for the missing country.

154. As a natural corollary to the development of a critical technical appraisal of the official national estimates, positive steps would need to be taken to provide for constant consultation with responsible officials in the government agencies, looking to improvement in the official national estimates. These consultations would naturally cover a wide field, ranging from questions on statistical techniques and the collection of the data to those relating to the timeliness of the submission of official reports. To ensure that adequate consideration be given to these matters, periodic appraisals of the technical staff of FAO might well be placed before national officials. A further step of potential importance in the development of the adequacy of the national estimates would be the publication of monographs concerning statistical methodology in the various countries. Particular emphasis should be given to those methods which the technicians of FAO consider to have proven fruitful in obtaining the desired degree of accuracy of estimation.

4. DEVELOPMENT OF STATISTICAL TECHNIQUES

155. The preparation of statistical summaries of world production and consumption entails consideration of many problems of statistical techniques. There is no generally accepted scientific approach to enumerating or sampling the many factors involved in setting up national estimates. Moreover, these problems run the whole gamut of difficulties inherent in the diversities of language, customs, and institutions in the several countries. An illustration of an important though elementary diversity is that of definition. Thus estimates of production in some countries include only commercial production or production for export. Commodity price quotations relate to market prices in some countries and to producer prices in others. Then, too, commodities of paramount importance in trade and in providing sustenance in one group are of only incidental interest in other groups. Some means must be found to develop in the statistical organizations of the contributing nations a common understanding of what is needed for an enlightened solution of problems. The diversity of interests of the several governments is reflected in the tremendous variation among countries in the statistical adequacy of the present measurements of food production. In some countries little information is available, since not even a periodic census has been taken for years.

156. The need for a census of agriculture at regular intervals has been mentioned and stressed. Such a census is basic to the establishment of statistical series needed by the nations. It does not follow necessarily, however, that other activities of a statistical nature should be delayed until the census figures are available. On the contrary, the whole project of taking a census of agriculture should benefit from previous experiences on the part of national statistical agencies in the preparation of estimates. These agencies may have been based upon any one of a number of sampling approaches, the problem of determining the level of and changes in agricultural production and consumption.

157. In the development of an estimation of production a common first approach should be the enumeration of that portion of the production which enters into trade—in other words, the commercial production. Where the production is largely exported, the commercial

production can be determined from export statistics subject to allowances for differences in stocks. A second approach is the enumeration of the production at the processing stage when it is first concentrated in the hands of a relatively small number of firms or individuals. In many countries arrangements for the enumeration of quantities of raw agricultural materials processed can be determined with relatively little expense either by enumeration or by sampling. The determination of the commercial production of a given item leads inevitably to the third step, namely, the estimation of the commercial quantity as a percentage of the whole. This problem ranges from one of extreme simplicity, where practically all the commodity moves in trade, to one of complexity, where only a small portion of the commodity is of a commercial nature and where it is produced on a large number of farms. In all studies of consumption levels it is important that due recognition be given to the quantities retained on the farm for use by the farm family or in the further production of agricultural products.

158. It is surprising that more of the countries have not developed means of bridging the gap in their published reports between commercial production and total production. A positive program looking to the bridging of this gap will do much to enhance the utility of the national estimates. In the process of determining the relationships of commercial to total production, there is much to be achieved in the clarification of divergencies in definitions, conversion factors, and similar attributes of the series.

159. The methods of estimating numbers of animals, unit yield of crops and of animal products, production of forest products and fish, etc., must be adapted to the peculiar conditions in the several countries. Statistical methods are a matter of development. In any given country a simple approach dealing with a few items and obtaining only rough measurements of agricultural production may be all that is practicable in inaugurating a program of agricultural statistics. But such a modest start should be and probably will be only the first step in the direction of a comprehensive and adequate system.

160. Progress in statistical techniques will be made in keeping with the interest displayed by administrators and technicians in that field. Such an interest can best be enlisted by encouraging in these officials a sense of joint responsibility in the statistical work of FAO. To this end their advice should be sought annually or more often, with respect to needed improvements.

161. At as early a date as possible FAO should undertake the preparation of a series of monographs or brochures illustrated with copies of questionnaires and descriptions of typical procedures that have proven successful in obtaining and processing statistics. These brochures should set out a range of procedures that have made possible the preparation of basic estimates. In the forefront of such discussions should be descriptions of simple yet effective means of measuring area of crops, forecasting and estimating unit yields, ascertaining market prices, and taking surveys of food consumption. Illustrations might be drawn also from the techniques used by the C.I.B. in unifying forest products statistics. In like manner, the experience of the Council for the Exploration of the Sea in compiling the basic data for its reports on

fish production in the eastern North Atlantic might well be set up as an illustration for use by countries for which fishery statistics have not been compiled. These brochures should be prepared and distributed to countries in which statistical work on food and agriculture is still in an experimental stage, or in which little or no agricultural statistical work has been done. Progressively, such a series of discourses should deal with estimates derived from processing data, international trade data, sample studies of representative localities and areas, and, finally, systematic sampling procedures covering all parts of the country.

162. Recommendations have been made earlier in this report that FAO arrange for regional or world-wide international conferences, designate panels of experts, and upon request send missions to countries in which the initiation or revision of statistical programs is under consideration. Obviously, all such means of contact should work in the direction of improving statistical techniques. Vigorous and aggressive action in keeping with such recommendations, therefore, should do much in moving toward this objective.

163. Since much of the statistical activity of nations is departmentalized, it will not be practical to cover the whole field of work of FAO in wholesale contacts. Conferences, missions, and consultations will need to be undertaken by FAO specialists working with country specialists. In many countries the work in many fields will be only in elementary stages or may not be under way at all. The specialists of FAO should be in position to devote whatever time and effort may be needed to assist in the development of such projects. Progress of necessity will be slow but the goal of general betterment merits the patience which will need to be exercised.

5. PUBLICATIONS

164. In some fields FAO will be starting almost completely new statistics, while in others it will take over and in the first instance continue what has gone before, as, for example, statistics of agricultural production. Even in these latter cases it does not follow that the series will be continued without change. The scope of FAO's work is wider than that of the prewar institutions and the intentions are different. FAO publications should reflect an active and forward-looking policy.

165. It seems reasonable to envisage four types of statistical publications—monthly, quarterly, annual, and occasional. Each of these is discussed below.

MONTHLY BULLETIN

166. Formerly the I.I.A. published a monthly statistical bulletin containing a miscellany of production and trade statistics, plus a few figures of stocks and prices. In contrast the C.I.B. published a monthly bulletin of considerable reliability pertaining only to forest products and covering production, sales, stocks, and prices.

167. Since monthly statistics are mainly required for study of market trends they are probably most usefully published on a commodity basis. FAO should not, therefore, aim at providing a comprehensive monthly bulletin. Rather there should be separate monthly

bulletins on products or groups of products. For example, there might be a bulletin on each of the following: food grains, feed grains, oilseeds, fibers, coffee, meat, dairy products, forest products, and fish. In due course there would have to be subdivisions of these groups and other groups too. Each bulletin should cover the world statistics of production, prices, stocks, trade, and consumption. There is no need to elaborate the pattern since models are available in various countries. These FAO bulletins should acquire a reputation for comprehensiveness, reliability, and promptness. They could become a highly valuable service in the work of adjusting production and consumption internationally.

QUARTERLY BULLETINS

168. There may not be much place for publications of this periodicity. Nevertheless, at the beginning of FAO's existence such bulletins might be useful for topics which had come to be dealt with on a monthly basis, for example, commodity studies of fruits and vegetables. Later on it is likely that topics that at first were treated annually might with advantage be dealt with quarterly, for example, surveys by nation and by region of production, trade, and consumption trends.

169. The monthly bulletins referred to above might include each quarter an enlarged number summarizing the statistics for the previous three months.

ANNUAL PUBLICATIONS

170. The *International Yearbook of Agricultural Statistics* was already becoming an unwieldy publication, and since one of the purposes of FAO is greatly to increase the range of statistical material, the yearbook will have to be issued in several volumes or sections. One possible arrangement might be to have a yearbook summarizing information country by country as has been done in the first part of the I.I.A. yearbook. This would include production in agriculture, fisheries and forestry, disposition of the output, stocks, and consumption. It would probably exclude foreign trade and price statistics. In addition there would be as many as three volumes divided by subject: one on agriculture and food, one on fisheries, and one on forestry and forest products. These volumes would include not only production and food consumption but also statistics of stocks, prices and international trade. It is not suggested that this is the only practicable arrangement for the material. It is mentioned by way of suggestion. The statistics unit of FAO should devote early attention to devising convenient arrangements.

OCCASIONAL PUBLICATIONS

171. Under this heading would come a publication of the results of a world census, occasional surveys on special subjects such as agricultural credit, the organization of forest industries as revealed in the production censuses, and so on. FAO should also publish a volume on coefficients and conversion factors more comprehensive than the I.I.A. booklet of 1926. It would from time to time produce reports of progress on the international problems of statistical methodology.

GENERAL OBSERVATIONS

172. FAO will have to decide what to do about the statistical series in the field of agriculture and food formerly published by international bodies. For the most part these series have been broken by the war, or continued only in skeleton form. Early steps should be taken to resume the publication of important series of data, but it is doubtful if the old institutions should be requested to approach governments for statistical reports and publish the results. It would seem preferable, while doing everything possible to expedite absorption, to wait until FAO itself can take up the publication of these statistical series.

173. Careful attention must be given to the layout of all statistical publications. It is particularly important to select a font in which the figures are clear and legible and to set out the headings and columns of tables in an orderly manner. The extent to which such publications are used depends in no small degree on their attractiveness and readability. The I.L.A. set a fairly high standard in these matters but improvements are possible in various directions, as, for instance, in the binding of yearbooks.

174. Timeliness in publication is another essential. It should be possible for FAO to produce its monthly bulletins with a time lag of not more than six weeks, and its yearbooks within six months of the end of the year. It is worth devoting considerable organizational effort to achieving this service. Indeed, it is often better to omit countries altogether or publish provisional figures appropriately marked rather than hold up the entire book until final figures are at hand. Much depends on establishing effective contacts with government departments.

175. FAO should indicate to the reader the degree of reliability of the statistics it publishes. Yearbooks, for instance, should contain adequate notes to explain the bases of calculation of the most important figures and defects in comparability as between countries. It is probably impracticable to go so far as to allot any formal grading to the statistics of each country, but where some doubt attaches to a figure, the fact should be indicated.

176. It is of the utmost importance that these publications achieve the highest possible standards of quality. FAO's reputation will depend, particularly in the early years, to no small extent on the standards it attains in this field. It will be a mistake to be ultra-cautious and passive in obtaining and publishing statistical material. It will be equally unwise to put figures merely to avoid leaving blank spaces, for in the event that one is proved wrong, a whole statistical document may come under suspicion. The tools must be good tools if FAO is to do a good job.

PART III. SUMMARY OF RECOMMENDATIONS

177. The Technical Committee on Statistics recommends that FAO:

(1) Establish a statistical unit and assign to it the task of planning statistical inquiries; collecting, compiling, and publishing statistical reports; improving statistical techniques; and such other functions as are needed to provide statistical information of high quality and utility.

(2) Develop a program of statistical inquiries to Member governments on nutrition and food management, agricultural production and primary processing, agricultural prices, fisheries, agricultural credit, forestry and primary forest products, and such other subjects as are primarily within its field.

(3) Arrange with the other international agencies for the collection, jointly or otherwise, of statistics relating to labor in agriculture, forestry and fisheries, international trade in agricultural products, and such other subjects as are of joint interest.

(4) Collaborate with the other international agencies that collect statistics in the international field by providing such other agencies with statistics in its field which they require, and by obtaining from them statistics in their fields which it requires.

(5) In developing the programs, at first confine the actual collection of reports from governments to series selected on the basis of relative importance and availability, keeping in view the broader objective to which energies will be directed, and providing for continuing progress in conformity with the abilities of the nations to establish the necessary means of obtaining the information.

(6) At an early date propose to the governments that they take a world census of agriculture, forestry, and fisheries by 1950 or as soon thereafter as practicable; and that FAO assume the lead in developing plans for such a census.

(7) Arrange regional and world-wide international conferences of technical workers in the several fields to develop programs of statistical inquiry and improvement in techniques in those fields.

(8) Select a standing advisory committee of statistical experts to advise with the Director-General on programs and procedures.

(9) Appoint panels of technical statistical experts in the several fields who will act in an advisory and consultative capacity to officials of nations requesting assistance.

(10) On request send missions to countries with inadequate statistical services to advise officials in matters relating to the development of the statistical work of the countries.

(11) Prepare brochures on approved and successful statistical methods as an aid to improvements in the statistical work of the Member nations.

(12) By all means at its disposal work toward a continuous improvement in national and international statistics concerning food and agriculture.

APPENDICES

I. COMPOSITION OF THE TECHNICAL COMMITTEE ON STATISTICS

1. This report was prepared by the Technical Committee on Statistics which began its work in July 1944. The Committee was composed of the following members :

Joseph A. Becker (U.S.A.), *Chairman*; Chief, International Commodities Branch, Office of Foreign Agricultural Relations, Department of Agriculture, Washington; formerly Chairman, Crop Reporting Board, Department of Agriculture.

R. H. Coats (Canada), Lecturer, Department of Economics, University of Toronto, Toronto; formerly Dominion Statistician, Bureau of Statistics, Department of Trade and Commerce

Octavio Alexander de Moraes (Brazil), Statistician of the Ministry of Finance, Rio de Janeiro

Václav Myslivec (Czechoslovakia), Professor, Czech Technical University, Masaryk Academy and Czechslovak Agricultural Academy, Prague

W. A. Stuart Williams (U.K.), British Food Mission, Washington

Conrad Taeuber (U.S.A.), Special Assistant to the Chief, Bureau of Agricultural Economics, Department of Agriculture, Washington

P. Lamartine Yates (U.K.), *Rapporteur*; Ministry of Agriculture, London

Dr. Robert M. Woodbury, Statistical Adviser, International Labour Office, Montreal, participated as an observer at the meetings of the Committee. Mr. Einer Cohn, Permanent Undersecretary, Denmark, participated in the last two sessions of the Committee. Mr. Darwish Haidari (Iraq), Chairman of Committee "C" of the United Nations Interim Commission on Food and Agriculture and Director of the Central Agricultural Experiment Station, Baghdad, and Mr. Frank L. McDougall (Australia), Chairman of the Reviewing Panel of the Interim Commission and Economic Adviser to the Australian High Commissioner London, participated in several of the meetings and made valuable suggestions.

II. SUPPORTING DOCUMENTATION

1. The following documents were prepared by subcommittees on basis for the report of the Technical Committee on Statistics. The classifications used are the Committee's code numbers by which the documents are filed in the Registry of the Interim Commission.

MEMORANDUM ON FORESTRY STATISTICS, by Egon Glesinger, Doc. 2, August 3, 1944, 11 pp.

- METHODS AND PROBLEMS OF INTERNATIONAL STATISTICS ON FOOD AND AGRICULTURE—A LIST OF REFERENCES, by Annie M. Hannay, Doc. 3, August 8, 1944, 7 pp.
- DRAFT MEMORANDUM ON PRICE DATA NEEDED BY THE FOOD AND AGRICULTURE ORGANIZATION, by Arthur G. Peterson, Doc. 4, September 6, 1944, 3 pp.
- PRELIMINARY DRAFT MEMORANDUM ON THE STATISTICAL WORK OF THE INTERNATIONAL INSTITUTE OF AGRICULTURE, by R. H. Coats, Doc. 5, September 6, 1944, 5 pp.
- AGRICULTURAL CREDIT STATISTICS AND THE FAO, by Norman J. Wall, Walter Bauer, and Oscar Zaglits, Doc. 6, September 6, 1944, 11 pp.
- FISHERY STATISTICS, by Murray Frank and R. H. Fiedler, Doc. 7, September 6, 1944, 11 pp.
- AGRICULTURAL STATISTICS, by S. W. Mendum, Doc. 8, September 12, 1944, 14 pp.
- METEOROLOGICAL STATISTICS, by C. F. Sarle, G. D. Cartwright, and H. C. S. Thom, Doc. 9, September 15, 1944, 2 pp.
- DRAFT MEMORANDUM ON STATISTICS OF FARM TENURE, by S. W. Mendum, Doc. 10, September 20, 1944, 2 pp.
- STATEMENT ON STATISTICS OF MARKETING IN THE FIELD OF FOOD AND AGRICULTURE, by R. O. Been, Doc. 12, September 22, 1944, 4 pp.
- STATISTICAL WORK OF THE INTERNATIONAL LABOUR OFFICE, by R. M. Woodbury, Doc. 13, September 25, 1944, 7 pp.
- DRAFT MEMORANDUM ON INTERNATIONAL STATISTICS ON AGRICULTURAL PRODUCTION, by Fred J. Rossiter and C. M. Purves, Doc. 14, October 17, 1944, 9 pp.
- DRAFT MEMORANDUM ON FOOD CONSUMPTION STATISTICS, by Montell Ogdon, James P. Cavin, Faith Clark, Katharine Jacobson, Faith M. Williams, assisted by Dorothy S. Brady and Esther F. Phipard, Doc. 15, October 28, 1944, 48 pp.
- STATISTICS OF INTERNATIONAL TRADE IN AGRICULTURAL PRODUCTS, by E. D. Durand (Supplementary Statement by O. Alexander de Moraes), Doc. 16, November 1, 1944, 18 pp.
- DRAFT MEMORANDUM ON THE WORLD AGRICULTURAL CENSUS BY THE INTERNATIONAL INSTITUTE OF AGRICULTURE, by J. Clyde Marquis (Supplementary Statement by O. E. Baker), Doc. 17, November 18, 1944, 9 pp.
- DRAFT MEMORANDUM ON AGRICULTURAL LABOUR STATISTICS AND THE FAO, by Louis J. Ducoff, assisted by ~~Douglas~~ F. Hale, Doc. 18, December 18, 1944, 11 pp.

